AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Hydraulic Punching and Shearing Machines.

We illustrate herewith an interesting line of hydraulic punching and shearing machines, of recent design. The introduction of hydraulic pressure plants into our boiler shops has become so general that it is found advantageous to extend this system with the other machines employed; the Pennsylvania Railroad Co. at Altoona, for instance, having recently equipped a new boiler shop of large proportions, where all the tools are driven by hydraulic power, this applying even to multiple punching machines, bending and straightening rolls.

The hydraulic method of operating punching and shearing machines does away with troublesome belting, and permits the machines to be placed anywhere in the shop that is most convenient, without reference to overhead supports for shafting, etc. The noise of gearing is also done away with, the operation of the machines being almost absolutely quiet.

If a belted machine is called upon to punch or shear a piece of work beyond its capacity, one of two things happens—either the belt fails or the machine is broken; there is no other alternative; while with the hydraulic tools, the stress that can be brought upon them is strictly limited by the area of the cylinder, and the pressure of water carried.

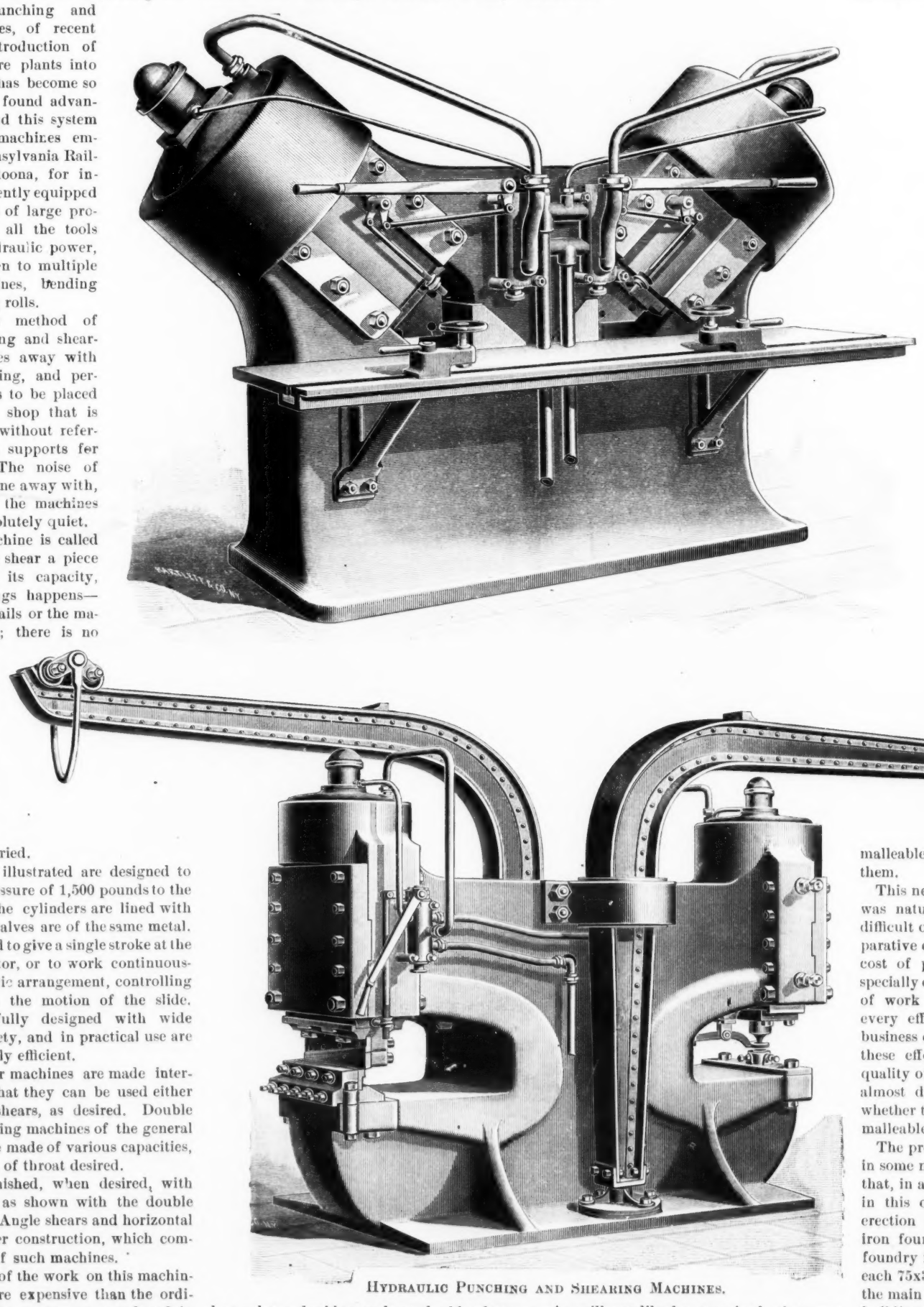
The machines illustrated are designed to work under a pressure of 1,500 pounds to the square inch. The cylinders are lined with bronze, and the valves are of the same metal. They are arranged to give a single stroke at the will of the operator, or to work continuously by an automatic arrangement, controlling the valves from the motion of the slide. They are carefully designed with wide margins for safety, and in practical use are found to be highly efficient.

All the regular machines are made interchangeable, so that they can be used either as punches or shears, as desired. Double and single punching machines of the general design shown are made of various capacities, and of any depth of throat desired.

They are furnished, when desired, with attached cranes, as shown with the double tool illustrated. Angle shears and horizontal punches are under construction, which complete a full line of such machines.

The character of the work on this machinery is rather more expensive than the ordinary type, but the parts are so reduced in number as to compensate for this, so far as cost of construction is concerned.

The first machine shown on this page is a double-angle shear, with table attached, in which is a T-slot to which clamping devices and gauges are secured. The second machine can be arranged as shown, or may be used as a double punch or double shear. Either of the machines on page 2 can be used, either for punching or shearing, and they are provided with every convenience in the way of adjustable strippers, gauges, etc., while the system of pipes and valves is so arranged as to give perfect control of the machines.



HYDRAULIC PUNCHING AND SHEARING MACHINES.

As will readily be perceived, these machines represent the latest and best ideas in machine design, and working tests have shown them to be highly efficient.

The line of machinery here described is built by the Morgan Engineering Co., Alliance, O., and is sold by the Niles Tool Works Co., 138 Liberty street, New York, who will furnish such further particulars as may be desired as to adaptation to specified conditions, etc.

Malleable Iron Castings.

BY S. BOLLAND.

The process of decarbonizing cast-iron, in order to produce malleability, has been known for over 150 years. It was described in 1722 by Reaumur, a distinguished French metallurgist and philosopher, and patents for its application to the production of malleable iron castings were granted to Samuel Lucas, of Sheffield, England, in 1804, and fifty years later to Brown & Lennox.

Lucas, in his specifications, describes it as a method of separating the impurities from crude or cast-iron without fusing or melting it, and of rendering the same malleable and proper for several purposes for which forged or rolled iron is now used; and also, by the same method, of improving articles manufactured of cast-iron, and thereby rendering crude or cast-iron applicable to a variety of new and useful purposes.

All this, as we now well know, was accomplished by simply casting such articles in any desired shape, and afterwards making them malleable by abstracting the carbon from them.

This new industry rapidly developed, as was natural, seeing that so many articles, difficult of forging, could be made with comparative ease this way, and thus reduce the cost of production immensely. Foundries specially devoted to the production of this line of work multiplied in all directions, and every effort was put forth to establish the business on a sure basis. Success attended these efforts to a marked degree, for the quality of the work done was so high as to almost defy the shrewdest to distinguish whether the products were malleable or only malleable cast-iron.

The present extent of the business may, in some measure, be estimated from the fact that, in addition to the already large plants in this country, there is now in course of erection at West Troy, N. Y., a malleable iron foundry to cost $100,000. The main foundry is to be 75x427 feet, with three ells, each 75x375 feet, and in close proximity to the main building is the annealing room, a building 80x450 feet.

The castings produced by this method are sometimes called "run steel," and very large pieces, such as gear wheels, etc., are

often cast and subsequently decarbonized. Screw propellers also are thus produced, in combination with "case hardening," or conversion of the surface metal into steel by a subsequent process.

Hydraulic cylinders which, under ordinary circumstances, would require to be cast six inches thick, are, by this process, made absolutely safe and water-tight at about half the thickness.

A great variety of articles formerly made by the blacksmith are thus produced in a more economical and correct manner than could be by forging. Bridle bits, parts of blocks, snuffers, various forms of builders' and domestic hardware, some kinds of culinary and other vessels, and numerous other things are thus produced. Many of these are subsequently case-hardened and polished.

A certain amount of polish may be imparted to malleable cast-iron without case-hardening, but the luster is by no means so brilliant. It may also be turned in the lathe with about the same results as wrought-iron, excepting that the tools suffer more under the operation.

The specific gravity of malleable cast-iron is a trifle less than cast-iron.

The softness and flexibility of this iron is remarkable, almost approaching wrought-iron, yet it is almost impossible to weld it, but it may be joined together by fusion, or brazed to steel and wrought iron by the aid of hard solder. Another of its characteristics, peculiar to wrought-iron or soft steel, is that thin pieces may be bent double when cold, but it is very seldom that the operation can be duplicated by bending it back again without fracture.

It would appear as if malleable cast-iron was the intermediate state between gray iron and steel, possessing a higher tenacity, with increased toughness, than the former, but differing from the latter in having a lower ductility, less tenacity, and in containing graphitic carbon.

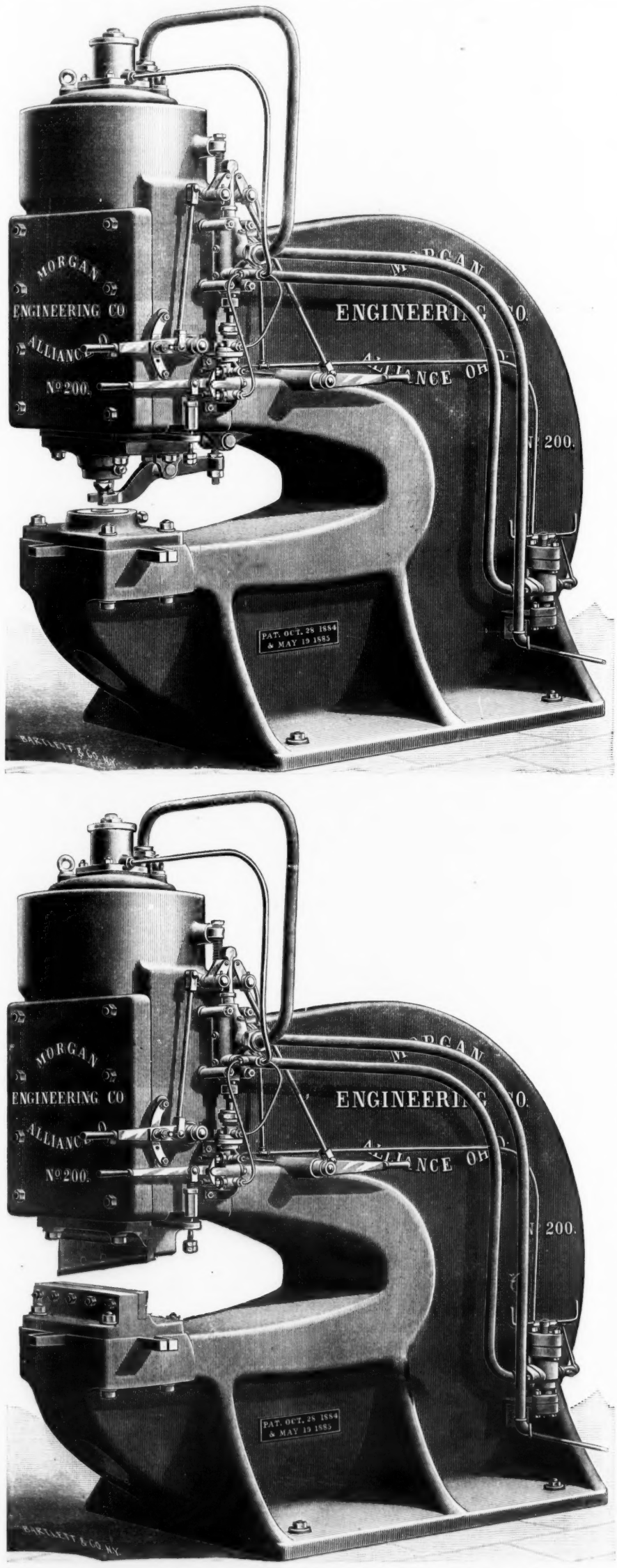
Malleable cast-iron, if plunged into water, red-hot, is hardened, but the process of tempering cannot be reliably performed, as in steel. At a moderate red heat it is possible to forge some of the best qualities, but if it is overheated it crumbles away as soon as it is struck.

Owing to the non-removal of constituents other than carbon by this process, it is essential that a fairly pure cast-iron be employed if it is desired to obtain a good malleable metal. English firms prefer the various brands of hematite, whilst in America the several brands of unquestionably good charcoal-iron are selected from.

The mottled irons are invariably preferred for this purpose, for the simple reason that the soft gray iron, whilst it may be best for ordinary purposes, on account of its superior fluidity, is totally unfitted for this work, because its carbon, being wholly or almost in a graphitic state, leaves the castings porous and weak after it has been abstracted from them by the process of decarbonization to which they are subjected. The white irons would be the best, having all their carbon in the state of chemical combination; but, on account of the latter mentioned condition, all such irons, when melted, are very sluggish, and consequently unfit for pouring into the molds. This accounts for preference being given to the medium or mottled irons. These irons are sometimes further strengthened by the addition of steel or wrought-scrap, the proportions of which alloys can only be determined by close observation and constant practice.

From the above general observations it will be seen that all soft gray irons are totally unfit for the production of malleable cast-iron, and that a decided preference is given to mottled charcoal and all such irons as have been smelted from hematite ores.

Claude Wylie, in his instructive work, "Iron and Steel Founding," says: "A short time ago we visited a foundry in England, where we were told they were making steel castings, and found the metal used to be old and burnt fire-bars, of which they had an unlimited supply. These fire-bars were melted in an ordinary quick-melting cupola, the castings were made in ordinary green sand, and after the sand was removed from them they were passed into an annealing furnace with a large proportion of hematite ore, and there brought to near melting heat; in fact, some of the boxes we noticed had a portion of them melted off; in three days they were ready for use. The old fire-bars re-melted would be most suitable metal for the purpose, containing no graphitic carbon, and little, if any, silicon. The castings we saw afterwards were all that could be desired as malleable cast; they bent and chipped like malleable iron, but could not be welded."



HYDRAULIC PUNCHING AND SHEARING MACHINES.—SEE PAGE 1.

The molding of malleable iron castings need not differ in practice materially from that which is followed in the production of ordinary cast-iron work, and it is usual to say that similar methods are followed; whilst this statement may be true partially, it is very evident that their practice is on the whole much superior to anything we see ordinarily in our best iron foundries. A most complete system of match plates, in conjunction with the almost faultless precision of the molding machines lately invented, conspire to make the molding of malleable iron castings a more accurate and reliable system than is dreamed of by those unacquainted with their methods.

Proprietors of iron foundries all over the country are becoming keenly alive to their own shortcomings in this particular, and are even now hastening to copy the methods so successfully inaugurated by their fellow-craftsmen in the malleable shops.

On account of the lesser fluidity of the iron used for malleable iron castings, it is usual to cut larger running gates into the molds, but care is taken in selecting the best place for such gates, so that there will be no fracture caused should it be forcibly torn off by the extra contraction and brittleness of the iron used; a very common occurrence.

Very much of the common run of work is run from an ordinary cupola after the regular manner, and not a little is melted in clay crucibles with a natural draught at the small places, but the reverberatory furnace is no doubt the most suitable means of supplying the right quality of metal for malleable iron castings. The iron, when melted in reverberatory furnaces, escapes immediate contact with the fuel, and, consequently, does not absorb any of its impurities, and, furthermore, any excess of carbon in the iron charged will be considerably lessened by the oxidizing action of the flame during the process of melting.

For heavy crucible melting in England, it is common to use a Siemens regenerative furnace, any degree of heat desirable being more certainly obtained at a much less cost for fuel than is possible by the old methods. The peculiar feature of this furnace is that the waste heat is employed to heat up both the gaseous fuel and the air requisite to burn it, before they are introduced into the chamber in which they undergo combustion.

An explanation of the theory of malleableizing cast-iron is given by Alder Wright, in Ency. Britt., who says: "In order to carry out the conversion of cast-iron into malleable cast-iron in this way, the articles to be treated are packed in cast or wrought-iron chests in oxide powder; the chests are then stacked, one above another, in a kind of reverberatory furnace, and gradually heated up to a red heat, which is maintained for the requisite time, after which they are annealed by slow cooling. With charcoal pig pretty free from silicon, sulphur and phosphorus, and with fuel in the furnace free from any large quantity of sulphur, a soft, but tough, tenacious and readily malleable skin is produced; if, however, the heating is continued for some time after the whole of the carbon originally present has been removed, the articles become brittle, owing to the formation of the oxide of iron disseminated through the mass, just as copper, bronze and analogous substances are rendered brittle through a similar cause.

"This circumstance, together with the known character of the chemical actions of carbon dioxide on iron and carbon at a red heat, indicates the nature of the processes taking place during the decarbonization. The ferric oxide, and the heated air in contact with it, first oxidize the carbon in the outermost film to carbon dioxide; this then passes inwards by the process of 'occlusion' (gradual solution of gases in solids), and reacts upon the carbon of the next layers, in accordance with the equation:

$$C O_2 + C = 2 C O,$$

the carbon oxide thus formed first becoming dissolved in the iron, and subsequently, when the iron is saturated therewith, gradually diffusing outwards, becoming converted into carbon dioxide as soon as it comes in contact with either the ferric oxide of the packing, or the partially oxidized iron of

the outer film, which, when free from carbon, reacts on the carbon dioxide thus,

$$_yCO_2 + _xFe = Fe_xO_y + _yCO.$$

"In the outermost layers, accordingly, there is always a tendency to the formation of iron oxide in virtue of this reaction, and simultaneously a tendency to the reduction of this oxide by the agency of the carbon oxide which is being formed in the interior layers and traveling outwards; as long as this latter action keeps the former in check, the accumulation of iron oxide in the outer layers does not take place to such an extent as to deteriorate materially the tenacity of the malleable iron skin, but when the carbon of the core has been so completely removed that the supply of carbon oxide from the interior almost ceases, the formation and accumulation of iron oxide in the outer layers goes on, rendering them more or less brittle. In the inner layers, the removal of carbon by the penetration of the dissolved carbon dioxide, and its reaction on the carbon, is continually progressing, the decarbonization gradually creeping inwards, as it were, until finally the innermost central parts become decarbonized also. The non-removal of sulphur, silicon, and phosphorus during the process is due simply to the fact that these elements are not acted upon by the occluded carbon dioxide as the carbon is, and consequently, not being oxidized, cannot be eliminated. The iron oxide used becomes partially reduced during the operation; in order to make it fit for use over again, it is moistened with a solution of sal-ammoniac, and exposed to the air in order to rust, and so re-oxidize it.

"The whole process is in effect an exact inversion of the chemical changes taking place during the manufacture of blister steel from malleable iron by the process of cementation, and differs from the ordinary puddling method for the purification of cast iron in this salient respect, that, in the latter case, the formation of the oxide of iron by the effect of heated air, and its direct addition in the form of 'fettling,' give rise to the production of a fluxed mass, in which is incorporated a notably larger amount of oxide of iron, which reacts on the carbon, sulphur, silicon and phosphorus, oxidizing them and converting them into products which are either gaseous, and escape (carbon and sulphur dioxides) or are non-metallic, and fusible, and hence separate from the iron as a fused slag or cinder."

Annealing or cementing furnaces are simply furnaces in which an article is packed in the powder of another substance, and therewith subjected to a continued heat below the fusing point. The article is changed by a chemical reaction with the powder.

Bar-iron packed in charcoal and heated in a cementing furnace becomes steel, the iron absorbing some of the carbon from the charcoal.

Cast-iron, packed in powdered hematite or smithy scales, and similarly heated, becomes malleable, the oxygen of the hematite or scales absorbing some of the carbon in the iron.

With some few slight modifications the cementing furnace for producing blistered steel will answer the purpose of annealing or decarbonizing cast-iron. Some of the late improvements in this country provide for the flame passing all round the chamber without coming into actual contact with the boxes containing the castings to be annealed. Access to this chamber is obtained at one end, where the boxes can be inserted or withdrawn at any time without interfering with the continuous working of the furnace. The saving in fuel, as well as to the furnace, will be greatly appreciated, as it allows of almost uninterrupted working, the consequence of which is that the expenses for repairs, incident to a periodic stoppage, are avoided.

The Siemens regenerative gas furnace is much used in England, for the annealing furnace as well as for melting with. As arranged for this purpose the furnace has four longitudinal main flues, divided by partitions into a number of smaller flues; the two exterior flues receive the heated gas, and the two interior ones the hot air. Over these is a closed arched muffle in which the annealing boxes are placed. The hot gas and the hot air, being kindled, pass beneath at the sides and over the top of the arch of the muffle. The furnace is never permitted to cool entirely, the boxes being allowed to cool on the floor.

It is necessary that all castings, previous to being placed in the annealing boxes, should be freed from every particle of sand; this is done either by abrasion in the tumbling barrel, scrubbing with wire brushes, or pickling in dilute sulphuric acid. If the latter method is adopted the castings should be thoroughly washed and dried before being placed in the annealing boxes.

The annealing boxes, sometimes called saggers, are usually made of cast-iron, the same nature as the castings to be annealed therein. For ordinary purposes they are about 13 inches in depth and width and about 16 inches long, and if carefully used they will last from 15 to 20 heats. For heavier and larger pieces special boxes are made to suit the requirements, wrought iron sometimes being used for the purpose, but these latter warp and twist out of shape in a very short time.

The articles when cleaned are, in some places, imbedded within the annealing boxes in powdered iron oxide, viz, a pure red hematite ore, as free as possible from all earthy matter; at other places smithy and rolling-mill scales or some analogous substance is used; they are then kept at a red heat in the annealing furnace for as long a time as required, when a diminution is produced in the amount of carbon contained, so that the cast-iron becomes more or less converted into soft iron.

When the action is pushed to the extreme, all or almost all of the carbon is removed, that in the outer layers disappearing first. Should the heating not be continued long enough to remove all the carbon, that which remains is found in the innermost layers, which constitute a core of more or less decarbonized cast iron with an outer skin of malleable iron.

The powdered iron ore mentioned above is sometimes objectionable, on account of the earthy matter which is sometimes mixed with it, more or less; this latter when present in too great quantity is fused by the great heat of the furnace, and adheres to the castings in the form of scoria; this not only interferes with the decarbonizing of the casting, but requires to be scrubbed off by a second hard application of the tumbling barrel, or some other means equally efficacious.

On the other hand, the scales are entirely free from such impurities, and do not interfere with the legitimate operations of annealing. As before noticed, the scales lose some of their oxidizing properties at every heat, but that is effectively renewed by the application of dilute sal ammoniac, and allowing them to rust again. By this means they can be used over and over again along with the new, which is added to make good the waste. When the ore is used it is previously ground and sifted; what passes through an $\frac{1}{8}$-inch sieve is rejected, as it contains too much earthy matter.

Packing the boxes is an important part of the annealing process. A quantity of the ore or scales is first placed on the bottom, on which, separate from each other, the first layer of castings are placed; these are then covered to a depth of $\frac{3}{4}$ inch with the ore or scales, on which the second layer of castings are placed, separate as before, and the operation continued until the box is nearly full, when the lid is carefully set in, resting on a final layer of the ore or scales; the covers are carefully luted, to prevent the admission of air. The boxes are usually inserted into the oven in pairs.

Long practice on the part of the furnace man qualifies him for judging how long a time each kind of casting requires for complete decarbonization; the heaviest are assigned to the hottest parts of the furnace, marked in such manner as will enable him to give to each class a period of heat proportionate to their bulk. For these reasons it is customary to place the castings in each box as near alike in bulk as possible.

The oxide which forms on the castings during the process of decarbonizing is a reliable indicator of the quality or degree of malleability obtained, the operator being able to judge of this according to the hues presented.

No matter how clean the scales may have been, all castings after being taken from the furnace require more or less cleaning to make them at all presentable.

The capacity of annealing furnaces varies somewhat, but they usually treat from 650 to 1,200 pounds at one heat. The length of time required is from two days to two weeks, according to bulk, but, as explained at another place, they must not be kept at too high a temperature, nor remain too long, or the result will be opposite to what is desired—the castings will be hard instead of soft. Usually the heat is gradually slackened for about 15 hours before taking out the boxes, and the latter are allowed to become cold before taking out the castings.

Condition and Prospect of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Maris Machine Co. (Engineers and General Machinists, Cranes, Portable Hoists, etc.), Philadelphia, Pa., write us:

Although competition necessarily continues to reduce the margin of profit, we have been able to more than counterbalance this by increasing our volume of business, and in spite of large additions to our equipment will enter the new year with more unfilled orders on our books than ever before.

This occurring at a time when our trade is usually a little dull gives us great encouragement, not only on account of the fact itself, but because the inference that our work has given satisfaction is inevitable.

We expect to erect new works in the spring, and with an increased plant and improved machinery from the best makers we have but little doubt of holding on to a fair share of trade.

In conclusion, will say that we are more than satisfied with the results of our advertisement in your paper; in fact, no other paper has given us more inquiries which led up to actual sales than yours, and we hope for our mutual benefit that there may be no falling off.

Webster & Perks Tool Co. (Solid Die Automatic Bolt-threading and Tapping Machinery, Aluminum Reducing Wheel, and Special Machinery), Springfield, O., write us:

Our year ending October 1 was most satisfactory in all departments. The demand for both the bolt machines and the reducing wheels has exceeded our most sanguine expectations, and we are, at the present time, working hard to fill orders.

We have just completed a new special bolt machine for small work, which is very fast; we are also pushed on this machine.

We have during the year designed and built tire-forming and bending machines, bale tie machines, weight-registering attachment for coal mining scales, facing and edging stone frames and carriages, and a number of minor machines. We have also rebuilt and installed a number of power plants during the year, and are at the present time installing a 300 H. P. Corliss engine with a battery of boilers for the Standard Mfg. Co. of this city.

The outlook for the coming year is most encouraging with us.

W. P. Davis (Machine Tools), Rochester, N. Y., writes us:

Referring to your letter regarding last year's business, will say the first six months of the year were somewhat light, but for the past six months business has been steadily increasing, except about a month during the election excitement. Since that time, however, it has improved materially.

I have within the past year somewhat increased my line of tools I manufacture at my factory. In addition to my line of drills, key-seating, cutting-off and milling machines I have recently brought out a 16" and 18" lathe. I have found the general inclination among manufacturers is to reduce prices, and I believe there has never been a time when a machine shop could be equipped with as good a quality of tools and at as low a price as at present.

As I have always been a liberal advertiser, my machines are well known all over the country, and I have never had as extensive a correspondence as for the past few months. This comes from no particular locality, but all over the United States, which shows to me conclusively that people are getting ready to buy more liberally than they have been doing, and believe I have every reason to expect a good business for the coming year.

The Berlin Iron Bridge Co. (Engineers, Architects and Builders of Iron Bridges, Iron Buildings, Iron Roofs, etc., etc.), East Berlin, Conn., write us:

We are well satisfied with our business during the past year, and regret very much that the American people are not willing to leave well enough alone. We certainly do not want any better business than we have had in the last three months. We naturally feel prosperity or adversity among the manufacturing industries quicker perhaps than any other business, and everything indicated to us that the past six months were the most prosperous among the manufacturing industries that we had ever known. What effect the late election will have, and whether the party in power will undertake to make any change in the tariff we are unable to say, but if 1893 is as good a year for business as 1892, we will not find fault.

The Billings & Spencer Co. (Machinists' Tools and Drop Forgings), Hartford, Conn., write us:

Our business for the year 1892 has not exceeded that of 1891, but has been satisfactory to us. We have made extensive additions to our facilities in the way of new buildings and new machinery. We are at present putting up new buildings, comprising storehouse, office building and machine shop, dimensions of which were given Mr. Miller when he last called on us. We consider the outlook for 1893 to be encouraging.

Bradley & Company (Power Hammers, Forges, Feed-water Filters, etc.), Syracuse, N. Y., write us:

We have found business somewhat better than last year with our power hammers; in fact, quite a gratifying increase can be reported.

A few months ago we commenced placing on the market the Bunnell feed-water filter, designed to remove all scale and mud-producing substances from water for feeding steam boilers before it enters them. As we have an apparatus which we guarantee in the strongest terms, there is no question as to its ultimate successful sale, but we have to contend with a universal unbelief that such an apparatus can be produced.

The E. Horton & Son Company (the Horton Lathe Chuck), Windsor Locks, Conn., write us:

During the past year we have placed upon the market several new sizes and styles of chucks, all of which are meeting with success. Our business has increased, and is gradually extending over a wider range. We are sending our chucks to all parts of the civilized world. We are contemplating further enlargements in the near future, providing that the prospects look promising for a good business. It is too early yet to predict what the future will bring forth in the way of business.

George B. Grant (Gear Wheels, Gear-cutting Machinery, Gear Cutting), Lexington, Mass., writes us:

Business for 1892 has been dull and unsatisfactory. It would be a good thing for all useful trades if the tariff question would get settled, one way or the other, for this continual tinkering with it prevents the larger manufacturers from making their plans. They can do nothing until they know which way the nimble politicians are going to jump.

My chief move has been to establish a branch gear shop in Philadelphia. I found it necessary to get nearer my customers in the Middle States, and Philadelphia is a good distributing point.

Schleicher, Schumm & Co. (The "Otto" Gas Engine), Philadelphia, Pa., write us:

We are happy to report for the last year a considerable increase in business; however, prices are low, and margin of profit small.

Fitchburg Machine Works (Metal-working Machinery), Fitchburg, Mass., write us:

Our business for 1892 has had no special features. We have been very busy all the time, and the amount of our product has been limited only by our capacity.

The greatest reason we have for finding fault is the tendency to lower prices, below the point where a fair margin is left for the manufacturer, and as the tendency, every day in the year, is to raise the standard of excellence and incidentally increase the cost, the manufacturer is obliged to have constantly before his mind the fact that "eternal vigil-

ance" is the price he must pay in order to find the balance on the right side at the end of the year.

If no action is taken by Congress to disturb the present business relations we see no reason why the good business of this year should not continue.

The Skinner Chuck Co. (Independent, Universal, Combination Lathe Chucks and Drill Chucks), New Britain, Conn., write us:

Our business for the last year has been larger than ever before. We have added some new varieties of chucks to our list, and by obtaining the very best machinery, and employing skilled labor, we endeavor to have our goods as near perfect as possible. To meet the demand we have been obliged to increase our facilities for manufacture by opening a new room and putting in new machinery and other appliances necessary for the increase in our business.

J. E. Snyder (Upright Drills), Worcester, Mass., writes us:

My business the first nine months this year was very satisfactory; since then trade has fallen off, as we expected, on account of the late election. Judging from the inquiries we are receiving, we feel confident of good business the coming year. I have added considerable in the line of small tools and appliances the past year, and also have added two or three more sizes of drills to my list.

W. A. Smith & Co. (Mechanical Engineers and Draftsmen, Hardware Specialties, Designers of Machinery and Tools, etc), Providence, R. I., write us:

As we have been located here only a year we cannot compare our business with any previous report, but in the year past we have found it necessary to more than double our capacity in the hardware line, while in the designing and building of special machinery and tools we feel that we are getting our share. For the last six months we have found it necessary to run both departments 15 hours per day, to keep up with our orders

We have good reason to expect that 1893 will prove a good year for us.

American Standard Gauge and Tool Works (Measuring Machines, Fixed Caliper Gauges, Adjustable Hand Reamers, Rose Reamers, Reference Gauges, Adjustable Shell Reamers, Hardened Steel Mandrels, Corrective Gauges), Wilmington, Del., write us:

Answering your inquiry in regard to business for 1892, we have been busy all through the year, have made some additions to tools and appliances. The end of the year finds us with plenty of orders on hand, and inquiries from many quarters for small tools.

Buffalo Forge Co. (Manufacturers of Buffalo Steam Hot Blast Apparatus, Steel Plate Steam Fans, Vertical and Horizontal Engines, Cupola and Forge Blowers, Shavings Exhaust Fans, Hand Blowers, Forges, Drills, Blacksmith Punches and Shears, Exhaust Ventilating Wheels), Buffalo, N. Y., write us:

We do not know how we can better advise you regarding our business prospects and progress than to say that another material enlargement to our works is necessitated by the continued increase of orders. We are now erecting a new machine shop of the "gallery" type, 185 feet by 210 feet, and are also largely increasing our foundry space.

The Lodge & Shipley Machine Tool Co., (Motor Gear Lathes, Special Turret Lathes, Pulley Lathes, Boring and Turning Mills, etc.), Cincinnati, O., write us:

March 1st—We began manufacturing a "pulley lathe" and placed several of them immediately.

July 1st—We took up the "motor gear lathe," and have sold them to all but two or three of the prominent manufacturers of motor gears in the United States.

September 1st – We began on our "turret engine lathe," which is a combined pulley lathe, engine lathe and turret lathe. This is a lathe on which we claim we can manufacture more pulleys in a given time than can be manufactured on any other one machine. The machine turns, bores and trues the edges at one operation, or bores at one operation and turns and trues the edges (the work being held on a mandrel) at a second operation.

Our machine especially designed for manufacturing bridge pins will soon be placed on the market. This machine will effect a saving to bridge and roof builders.

We are constantly in receipt of letters from those using our machinery testifying to the great saving of labor accomplished by the machines.

Our building, which is within seven minutes walk of the center of the city, gives us 22,000 square feet of floor space, most of which is very well lighted.

We anticipate a largely increased trade for the coming year, and have orders for two months ahead. The number of employes is being constantly increased. We have been running 60 hours a week regularly, besides considerable night work.

Manufacturing anything so novel in its construction demands constant improvements in methods, which we are meeting by the addition of such machinery as is best adapted to our needs and by the employment of efficient workmen.

Our prices have not been changed since their establishment. We have not experienced any fluctuation in the price of labor.

The Curtis Regulator Co. (Manufacturers of Engineering Specialties, Steam Water Pump and Damper Regulators, Traps, Valves, etc.), Boston, write us:

Our business continues steadily to increase at an average rate of 20 per cent. a year. Having been crowded out of our old quarters, by its accumulation, we have recently moved to a new shop in Charlestown, 105x 45, with 100 horse-power engine on same lot as our foundry. We have leased a store, 29 to 33 Haverhill street, into which we moved our offices and salesroom. This is 70 x45, five stories, two of which and the basement we use for our business and let the rest. Our orders have rapidly increased since the elections. The country is safe. We make a full line of regulators, traps, boiler feeds and separators (after our own patents) which seem to meet public approval.

A. D. Quint (Six-spindle Turret Drill Press), Hartford, Conn., writes us:

My business, not yet a year old, has steadily increased from the first, with orders mostly from the Eastern and Middle States; also a good demand for export. With other orders last month was one from Russia.

I have devoted much time and thought the past year to special tools and fixtures, to improve the quality and reduce the cost of labor on drills, which I now build in quantities of 25 at one time.

My special arranged turret drill for light tapping gives good satisfaction where used.

I expect an increased business next year as the merits of machine become known through judicious advertising; also through exhibition at the World's Columbian Exposition.

S. M. York (Machinery and Engineering), Cleveland, O., writes us:

We are pleased to say that the volume of our business for the year 1892 has been greater than we anticipated from the indications at the beginning of the year. We have increased over last year about 30 per cent. In regard to the outlook for '93 we are not so confident. Business the past month or six weeks has been more quiet than at any time during the year, which may, however, be caused by parties not desiring to increase their stock more than absolutely necessary pending inventory. Inquiries are quite brisk, and we have every hope that business in '93 will be fully as good as the past year. Margins continue to be exceedingly close and collections a trifle hard at present.

Landis Bros. (Tool Builders, Universal and Plain Grinding Machines, Vertical Boring Machines and Special Tools), Waynesboro, Pa., write us:

Our business has been a good one for the year 1892. We are having a gradually growing trade for our universal grinding machines. We have exported a number of these machines, and in every instance as well as all that have been placed in this country, they are giving universal satisfaction. Our prospects for another year look well, and, on the whole, we feel much encouraged. We are bringing out a few other new tools; among them is a vertical boring machine, which has some new features which will be appreciated, and which, as soon as we get into proper shape, we ask you to describe in your columns.

We have also in the past year moved into new and much larger and more commodious shops, with which we have a foundry which gives us much better facilities than we had before, and we can assure our customers that what we will furnish will be of the best in every particular.

A. R. King Mfg. Co. (Foundry and Machine Works, Heavy and Light Castings in Iron, Brass and Composition, and General Machine Work), Jersey City, N. J., write us:

In regard to business prospects, etc., would say our business for the past year has been larger than for the year previous, and we note that during the past month or two the volume of business has not materially lessened, as is usual at this time of the year. This we take as an indication that orders are plentiful and require to be immediately completed. We have not made any enlargement of our works during the past year, but have added several new tools to our machine department. We have also brought out one or two new machines, notably our machine for sawing hot metal. We are also engaged in the manufacture of a new chain block, which we propose to have on the market at an early date.

The prices of labor remain about the same, and there has been no material change in the price of raw materials since the first of the year. We look for a good business during the coming year.

John Wiley & Sons (Publishers of Scientific Text-Books and Industrial Works), New York, write us:

Our business this last year has been very good, and the sale of our stock and plates of John Ruskin's works to the D. D. Merrill Co., of St. Paul and New York, has enabled us to devote our entire attention and energy to the publication of scientific books.

In the department of mechanical engineering we have published this year Meyer's Modern Locomotive Construction, Peabody's Valve Gears, Bolland's Iron Founder, Flather's Dynamometers, MacCord's Mechanical Drawing, Church's Notes and Examples in Mechanics, and Carpenter's Experimental Engineering.

In the department of civil engineering—Berg's Buildings and Structures of American Railways, Baker's Engineers' Surveying Instruments, Merriman's Geodetic Surveying, Merriman's Walls and Dams, Byrne's Highway Construction.

In mathematics—Halsted's Synthetic Geometry, Chapman's Theory of Equations and Johnson's Least Squares, while in general science Dana's System of Mineralogy, Barker's Deep-Sea Soundings and Tillman's Elementary Lessons in Heat have been successful.

We have also published Ihlseng's Manual of Mining, which has given to mining engineers a work they have long needed.

Our advertisements in the AMERICAN MACHINIST have been a great help in the sale of our books, and make us believe that your paper is read from cover to cover.

Pawling & Harnischfeger, Milwaukee, Wis., write us:

We may say that we have been unusually busy and feel more than satisfied with the general result of the year's work.

We have built, during the year, quite a number of electric and power cranes, and have enough work in this line on hand to keep us quite busy for at least six months. Among other work which we have been busy on we may mention three large armature lathes which we are just finishing for the Siemens & Halske Electric Co. One of these lathes will turn armatures 16 feet diameter for a 2,000 H. P. generator, and the other two will handle armatures 10 feet diameter. These machines are specially designed for this work for the Siemens Co., who are already under way in their new works in Chicago.

In the line of wood polishers business has been very good, and we have also done a fair business in vacuum grain dryers, hop extractors, and other special machinery in the same line. In steam steering gears we have also done a very fair business, and we may say the same of steam feed engines for operating saw-mill carriages, roll tables, etc.

In July we ran off the first heat in our new foundry, but before three months had passed we were compelled to enlarge in order to be able to keep up with the work.

In short, with us business has been so good, and the future so encouraging, that we have already prepared plans for large extensions to our present plant, and will begin building operations in the near future.

Armstrong Bros. Tool Co. (Armstrong Tool Holder for General Lathe and Planer Work), Chicago, Ill., write us:

The year of 1892 opened for us with orders rather scarce, and we had a big stock of tool holders on hand; but business increased from month to month as our tools became better known, until the end of the year finds our stock reduced to nothing, and we are hardly able to keep up with orders. A patent having been allowed us, we expect during the coming year to increase our plant and get out other sizes and shapes.

Alfred Box & Co. (Manufacturers Box's Patent Double Screw Portable Hoists, Radial Drills, Cranes, etc.), Philadelphia, Pa., write us:

Our business has been very steady and satisfactory throughout the year, with a possible 15 per cent. increase. We have added two 10-ton traveling cranes and five new machine tools, and taken in additional yard room for the erection of large traveling cranes. Our prospects for trade are good, and have considerable work on hand. The cost of material has been about the same as last year, and cost of labor unchanged; but we find good mechanics harder to obtain each year. Prices obtained for product average from 5 to 10 per cent. less than last year, and competition a little closer.

Ashley Engineering Company (Steam Specialties and Machinery, Consulting Engineers and Contractors), New York City, write us:

Our manager has been out of town, or you would have received this before; but if it is not too late we should be glad to see it published. We manufacture steam specialties of all kinds, steam whistles, automatic water gauges, gauge cocks, valves, etc., and our business has increased very much during the past year. We have a factory at Hawthorne, N. J., that has been running for about a year. We have twelve men in our employ, and expect to employ double that number before another year passes; also agents in quite a number of States Our orders have also increased wonderfully, and we expect within the next year that our business will increase to double the amount it has been this year. Our New York office is at 136 Liberty street, and there we receive all inquiries in regard to our goods.

J. H. McEwen Manufacturing Co. (Automatic Engines, Steam Boilers), Ridgway, Pa., write us:

We have found it necessary, owing to the wonderful sale of our automatic engine, to give up other work and devote ourselves exclusively to its manufacture. We employ about 125 men, and have about doubled our works the last year, but still find our capacity inadequate to supply the demand.

We are building new works that we think will be as complete as any in the country. They will be entirely of steel, excepting roof sheeting and floors. The gallery floors will be of oak, and the ground floors of paving brick. The works will be supplied with electric and hydraulic cranes; railroad tracks will extend into the works, so that all loading and unloading can be done with electric cranes.

The future looks bright to us, and we are making no effort to secure orders, but still they come. We have now orders for twenty-six engines, varying from 60 to 400 H. P.

George D. Walcott & Son (Machine Tools), Jackson, Mich., write us:

In our letter at this time last year we made mention of having enlarged our shops, and since then have again found it necessary to have more room. This addition was completed about two months ago, and are now settled in very comfortable shape. Our business for 1892 has been very satisfactory, and at the present time are very busy, working more help than ever before. It is hard to tell what the new year will bring, but the indications are for a good trade, and we shall hope it may be so.

American Gas Furnace Company, New York, write us:

We are happy to say that we have every reason to be satisfied with business. It is a peculiarity of our special line that manufacturers who give us an order for a gas plant or blast furnaces are usually confronted with a large outlay of cash for a thing which replaces another, the cost of which was comparatively trifling. A gas blast forge, with blower, etc., complete, costs not less than $75 ready for work, while the coal or oil forge it replaces has cost probably not to exceed $15 or $20; and a gas plant at $3 000 to $6,000 usually replaces coal or coke furnaces, the total cost of which was less than 10 per cent. of that amount. Such outlays, no matter how great an improvement in methods of work and its quality they may produce, are not made except in prosperous times, and having all the orders we can attend to, entirely unsolicited, too, except through our advertisement in your columns we must pronounce the condition of business "good," and prospects for '93 better—excellent, in fact. An acquaintance with a large number of manufacturing establishments in varied lines of production enables us to say that confidence in the future prosperity of our country and its splendid industries seems to be unimpaired, and we are working hard to deserve, honestly earn, our share of it.

Buffalo Steam Pump Co. (Steam Pumping Machinery and Independent Condensers), Buffalo, N. Y., write us:

Our business for the past year has been very satisfactory, much larger in volume than ever before, so much so that we have decided to change our present location, and have recently purchased property at North Tonawanda, N. Y., and have let the contract for the construction of new works. Our machine and erecting shops will be 160

by 190 feet, and foundry and pattern shops will be 80 by 342 feet. We shall have one of the most complete establishments for the manufacture of duplex pumping machinery in the country. We have gotten out an entire new line of patterns for boiler-feed pumps, fire pumps, water works pumps and mine pumps of the duplex type, all parts being interchangeable, and can be duplicated and furnished on immediate notice.

We have added to our business a single-cylinder air pump and jet condenser, for which we have found ready sale on account of the simplicity of the valve movement and economy in the use of steam. We expect from these improvements to largely increase our business and serve our customers better than ever before.

We are at work now on a new catalogue which will be issued very shortly.

William Whitlock (The National Chuck, General Machine and Experimental Work), New York, writes us:

I commenced to manufacture the old National chuck just one year ago, and am gratified to be able to report a steady growth in sales each month I have been in business, mainly resulting from my advertisement in the AMERICAN MACHINIST. During the year I have removed from Mt. Vernon to New York City, have added several machines to my plant, almost doubled the number of men employed, and have commenced the building of high speed marine engines. I am adding a line of drill chucks, and have gotten out a new pattern of our well known independent "National" chuck, which has the screw heads recessed, leaving the periphery flush. This is accomplished without in any way weakening the chuck, which has, in fact, been made slightly heavier and much stronger. I issue a new catalogue in January, and anticipate a prosperous season in 1893.

Kempsmith Machine Tool Co. (Iron and Brass-working Machinery), Milwaukee, Wis., write us:

During the year 1892 we have built and in August last we moved into a new brick factory building, dimensions as follows: Main building, 45 feet by 106 feet, 2 story, 30 feet by 45 feet one story ell, connected with main building, the one story part being used for engine and boiler house and blacksmith shop, and we are now working to better advantage than we could in our formerly very cramped quarters. We have added some new tools to shop equipment during the year, and have had orders enough to run our facilities to their full capacity, and we expect to add some new tools and materially increase our force of workmen early in the new year. Additions to our lines of machines have been somewhat retarded, owing to the fact of building our new factory, but as we are now in fine running order we will have more time to devote to developing new things. We have, however, added to our list during the year another new size of miller, and one new size and style of universal head. Prices of labor and material remain about the same as one year ago. At this writing we see no reason why we should not be fully occupied for the ensuing year.

Gould & Eberhardt, Newark, N. J., write us:

We have every reason to be well pleased with the success of our business during the year just about to close.

We have during this time increased our capacity 25 per cent., yet have been and are still pushed for our products, with inquiries coming in at the present time more numerous than ever.

We have orders ahead which will keep our works running for many months at least, and are constantly getting out new designs and improving old ones, and putting on the market machines of a higher character than we have ever done before.

There have been no special changes in the price of labor or materials generally.

We have added and are adding quite a large number of tools to our lines of manufacture. We have added probably more in the last year than in any two previous years, and had to add quite a little special machinery.

We are bringing out an automatic motor gear cutter which promises to accomplish work never attained to before.

The Lunkenheimer Brass Mfg. Co., Cincinnati, O., write us:

The year 1892, although a "presidential year," has been the largest in the history of our company, and we think will prove to be the case in nearly all lines of business which in a measure proves that the politics of our country are shaping themselves in a good, healthy and conservative channel; that men may come and men may go, but business goes on forever.

Business this year has been paramount to politics, which bespeaks volumes for the future, and not, as heretofore, subject to the whims of others or influence of this or that sect or party.

Prices on an average for the year have been low, but with the rise in copper, cotton and other commodities, will bring higher and better prices for the year 1893.

This being the time of the year when all lines of trade are more or less quiet, we find our order books over crowded, which shows that the demand for "Lunkenheimer specialties" is growing faster than our production; in fact, our trade has assumed such proportions that our present facilities are inadequate, and in order to handle same with promptness and dispatch we have increased our capital stock to $500,000, and about January 1st, 1893, our manufacturing facilities will be nearly doubled by the addition of new buildings.

Going largely into the manufacture of iron steam goods, and for the convenience of the trade, we have changed the style of our firm name to "The Lunkenheimer Company," to take effect January 1st, 1893, and the officers of the new company will be: Edw. H Lunken, president; C F. Lunkenheimer, vice-president and treasurer, and D. T. Williams, secretary.

The prospects for 1893 are exceedingly bright.

The George Burnham Co. (Patent Improved Drills, Hand or Power, also Clamp Drills), Worcester, Mass., write us:

My business for the year 1892 has been fully as good as in 1891, with the prospects of even better results for 1893. I have not enlarged my plant during the year. I have the latter part of this year taken on a 13-inch sensitive drill to manufacture, in addition to my regular business, and may in the near future need more room and tools.

Chas. A. Strelinger & Co. (Hardware, Tools and Supplies, Machinery), Detroit, Mich., write us:

Replying to your favor of 10th, would say that the past year's business has been quite satisfactory, had a helpful increase, and from all appearances the coming year promises well.

We are hard at work on a new catalogue of metal workers' tools, machinery and supplies, which we hope to have out before a great while.

J. T. Slocomb & Co., Providence, R. I., write us:

Our business during the year of '92 has been as good as we could expect, except for the last two months, which we have found rather quiet. We think this quietness due to political affairs, which will not last long; in fact, we see now unmistakable signs of improvement.

During the year we have made quite a number of improvements relating to the manufacture of our specialties, and have perfected several new tools.

We think the prospect for next year good, and we are laying our plans to correspond with this idea.

Morton Manufacturing Co. (Builders of Morton's Key-way Cutting, Key making, Portable Planing, Shaping and Special Machinery), Muskegon Heights, Mich., write us:

We would say that during the year '92 we have found business fair. Machine tool business during some portion of the year '92 was excellent, and though the political sentiment occasioned in the latter part of the year has had some effect on trade, yet taking the year all through it has been generally satisfactory. The prospects for the year 1893 at present look very good, and we have a greater number of inquiries than we had last year at this time, and from the general tone of inquiries we look for many sales as soon as the year's business is closed up.

We have brought out and perfected a line of shapers in addition to our key way cutting and key making machinery.

We have added several new machine tools and are making preparations for a larger volume of business than last year. We do not look for any radical or unwise legislation regarding our tariff laws, and trust that the incoming party will be prudent and accurate in whatever new laws that will affect the manufacturing interests of the country.

Bickford Drill Company (Machine Tools, Upright, Radial and Universal Radial Drills, Boring and Turning Mills, etc.), Cincinnati, O., write us:

In the year just closed we have sold more machinery than in any other previous year since we have been in business. The prices of machine tools, however, continue to have a downward tendency, and consequently the margins left for the manufacturers are very close. In January, 1892, we engaged the second floor of our building and thereby secured almost twice as much space as we had before. We have also added quite a number of new tools such as lathes, drills, gear cutter and special machinery adapted for our line of manufacture. We have also completely changed the patterns of our tools and have added three new sizes of radial and universal radial drills, one new size of boring and turning mill, and have also engaged in the manufacture of special drilling machinery. We have now under way several new tools which we hope to present the early part of next year. In the past year we have employed a larger number of men than ever before, and have always run our shop on full time. At present the prospects for the coming year look very favorable, and we hope for a steady trade in 1893.

Manning, Maxwell & Moore (Railway and Machinists' Tools and Supplies), New York, write us:

The business of 1892 has been quite satisfactory to us. Prices have generally ruled lower, but we find a very healthy demand for goods in our line.

We are about going to press with our new catalogue, to which our Mr. Manning has devoted two years of his time in compiling, and will contain nearly 1,200 pages of imperial quarto size, and we expect to complete it and begin delivery of the same early in 1893.

We also contemplate making a large exhibit at the World's Columbian Exposition.

We have secured new offices and storerooms on Canal street, in Chicago, for our branch office there, which will be in the new building known as the Machinery Hall, which will be ready for occupancy by us early in February, and we are increasing our corps of men at the western office.

We find a growing demand for heavy, powerful tools, well made, and for a better quality of supplies than in the past. Purchasers seem to be more appreciative of good goods as they come to value their money closer and give more attention to their purchases.

We consider the outlook very favorable for a fair business in '93, aside from the temporary effect it may have on trade during the World's Columbian Exposition.

Howard White (White's Patent Flexible Metallic Fillet), Philadelphia, Pa., writes us:

I will say I have the exclusive handling in this country of flexible metallic fillet and stamped brass letters and figures for use on wood patterns, and that my aggregate sales of each of these during 1892 have exceeded that of any other year. The fillet has been sold for nine years, and I will look for a still further demand next year.

Wiley & Russell Manufacturing Company (Manufacturers of the Lightning and Green River Labor saving Machinery and Tools), Greenfield, Mass., write us:

Business has shown a gratifying increase over the last year. The demand for our spiral reamers has been constantly growing, and the introduction of the full-mounted lightning screw plate (a stock to each die) has had a very marked effect. There has also been a good demand for our opening die-bolt-cutting machines. We have every reason to hope for an excellent spring trade.

The Bradford Mill Co (Machine Tools), Cincinnati, O., write us:

The volume of our business slightly exceeds that of the previous year, though, with improved facilities added during the year, we could have handled more trade.

Our methods are being continually improved, enabling us to produce the highest class of work.

Prices of labor and material have scarcely varied any, as is also the case with our finished product.

In addition to our trade in this country, which extends from one coast to the other, we have received some flattering foreign orders, namely, from England, Russia, Siberia, Australia. Judging from this month's orders, which exceed any in our history, we look forward to a prosperous year of business.

Hamilton Machine Tool Co. (Drill Presses, Grinding Machinery, etc.), Hamilton, O., write us:

Would say that our business during the year just closing has been eminently satisfactory to us in every way, but especially so during the past eight months. During the month of July we doubled our shop room, and added again as much machinery as we had previous to that time. So great has the demand been for our upright drill presses, that, even with our increased facilities, we were compelled to do a great amount of night work. We are now running to our fullest capacity, and are again crowded for room. If our business continues to grow as it has done during the past year, it will be but a short time before we will find it necessary to seek another location, as we are not only cramped, but seriously crippled for floor space. Orders during December have not been as plentiful as they were, but on the other hand there was not a month during the eleven preceding ones, which brought us as many inquiries from prospective buyers, who will probably not place their orders until after the first of the year. We learn that all our local manufacturers are running over-time, with sufficient orders booked to keep them busy well into the new year. So far as we can see and learn, everything points to an increase of business for '93.

Ferracute Machine Company (Presses, Dies and other Sheet Metal Tools), Bridgeton, New Jersey, write us:

It is difficult for us to give you a report on our business just now, as we do not make up our books until Jan. 15.

The past year has been a prosperous one with us. We have not enlarged our works, but have added considerable new machinery, and have improved our method of production. We have had a steady run of orders, and have kept busy throughout the year. Just at present we have a larger number of orders in probably than ever before, and are fitting up a number of large factories with their machinery and dies for manufacturing various sheet metal goods.

We do not think there has been much change either in the price of labor or materials. The prospects for the coming year are good, as far as we can see, although trade may be a little slow during the first two or three months, until political matters are definitely settled.

We expect to make a large and fine exhibit at the World's Fair in Chicago. We are now manufacturing some heavy presses, weighing 20,000 pounds, both for large sheet metal work and for heavy punching and shearing work in bar metals. We think our production during the past year has been greater than in any previous year in our history.

Westcott Chuck Company, formerly Oneida Steam Engine and Foundry Company (Manufacturers of Westcott's Lathe and Drill Chucks, etc.), Oneida, N. Y., write us:

Throughout the year now ending we have enjoyed a large and steady demand for our chucks, at uniform and satisfactory prices. Have employed full force of operatives in our factory constantly at normal rates of wages; at present writing all hands are working over-time three evenings in each week.

With the exception of a considerable reduction in price of pig iron, occurring early in the year, we have experienced no noteworthy variation in prices of materials purchased. Both export and domestic shipments have been very heavy.

Orders are now coming in well from all sources, and prospects for the future are unclouded.

Hugo Bilgram (Engineer and Machinist, Maker of Special Machinery, Sole Manufacturer of the Heyl & Brehmer Pat. Wire Book Sewing Machine, etc.), Philadelphia, Pa., writes us:

In response to your inquiry I would say that the favorable expectations formed at the close of last year, 1891, of business for the ensuing year, 1892, have been fully realized.

The volume of work in the bevel gear cutting department has steadily increased, more than keeping pace with the increased facilities provided.

In the department of construction of special machinery I am fully engaged, having orders on hand that will keep me busy for several months.

Gisholt Machine Company (Manufacturers of Turret and Engine Lathes, Universal Tool Grinders and Special Iron-working Machinery), Madison, Wis, write us:

The demand for our turret lathes is constantly and rapidly increasing. Manufacturers are learning that much of their work, such as friction clutches, couplings for shafting, Corliss engine bonnets, cone pulleys, etc., can be done on turret lathes for a fraction of what it costs in the usual way. The same is true as to bar work.

On our machines bicycle wheel hubs are made from the end of the bar at almost nominal cost. We also make long pieces from the bar, as we have a gripper that supports the outer end.

We build machines of all sizes, from the small screw machine to those having a 4¼" hole through spindle, swinging 34" and weighing about 14,000 pounds. We are also building gap turret lathes swinging up to 50". For bar work we have an automatic chuck and automatic wire feed that practically eliminate the time of feeding the bar.

We are now making the machines in large quantities, so as to reduce the cost to a minimum, jigs and templates being used, and all like pieces are absolutely interchangeable.

Our standard tool grinders are now made in lots of fifty, which, better than anything else, shows what the demand is for them.

Jeanesville Iron Works (Pumps, Mining Machines, etc), Jeanesville, Luzerne County, Pa , write us :

The last year has been a very busy one for us, coming fully up to our expectations, when we wrote you last year that we considered the prospects for the coming year as very promising. Our pump business has grown even faster than last year. We now have enough orders for pumps on our books to keep us employed until May.

The Ingersoll Milling Machine Co. (Manufacturers of Milling Machines, The Ingersoll Patent Cutter), Rockford, Ill., write us :

We beg to say that the first eight months of the year were dull months with us, but since September 1st we have been exceedingly busy, running our large machines all night part of the time. We have added several large tools, and have equipped our shop for handling heavy work.

We have also put on the market a new 36″x36″x8 feet slab milling machine, a new 24″x24′ x6 feet slab milling machine, a new 15″x15″x4 feet slab milling machine, and a new 60″ horizontal boring and milling machine. The prospects for '93 are very encouraging. We are receiving more orders at this time than ever before. We trust that this information is about what you wish.

Timothy Kieley (Champion Return Steam Trap, Eureka Pressure Regulator and Positive acting Pump Governor), New York, writes us :

In reply to your favor I would say that I am erecting at 13, 15 and 17 W. Thirteenth street, just alongside of my old stand, a six-story building, 50x 100 feet. This, I think, talks with sufficient eloquence concerning my business progress during 1892.

The National Machinery Co. (Specialists in Bolt and Nut Machinery), Tiffin, O., write us :

In regard to the year just passed, it has been fairly satisfactory ; there has been more conservatism in purchasing tools, but the market is continually spreading, so that the volume of our business has been equal to that of '91. We have also added considerable to our facilities for manufacturing any line of tools the past year.

Clayton Air Compressor Works (Air Compressors, Rock Drills, Mine Pumps, Air Receivers, Boilers, Crushers, Hoisting Engines, Electric Blasting Batteries, Mining and Tunneling Machinery), New York, write us :

The volume of sales during the present year is 25 per cent. in excess of that in 1891, notwithstanding which we have (owing to the improved machinery which we introduced into our works last spring) been enabled to keep pace with our orders.

Many inquiries for our new catalogue No. 7 are being received, which we anticipate will result in an increased business next year.

In addition to the air compressors sold for mining, tunneling, sinking caissons, and sub-marine work, we have done the bulk of the business in supplying these machines for aerating crude petroleum for fuel, working pneumatic riveters, tools and cranes, elevating acids and other liquids, and for experimental purposes.

Other letters stand over, to be published next week.

The fact that all over the country the holiday trade this year has been larger than ever before is taken as showing a healthy state of trade generally.

"Keep's Tests" for Cast-iron—II.

By W. J. Keep, Detroit, Mich.

Keep's Dead Load Testing Machine.—Fig. 16 is a single lever machine, in which, by moving a weight out on a beam *l*, a gradually increasing stress is applied to the center *i* of the test bar, which is held in flexible bearings *k k* exactly one foot apart. The beam is not kept floating, as in many machines, but as the stress increases it goes down with the center of the test bar. An autographic record is made of the behavior of the bar for every instant during the test.

The center *i* of the test bar is connected to an arm *a n*. The short end of this arm is attached to an adjustable flexible bearing *n*, and the forward end *a* carries a pencil which bears on the diagram paper. The proportions of this are such that the motions of the center of the bar are magnified five times on the paper, and the record must be measured with a scale divided to twentieths of an inch, and read as hundredths.

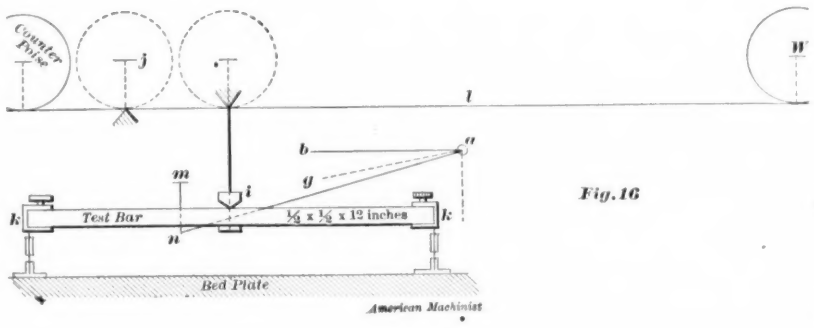


Fig. 16

The distance between the spring line *a f* at any point, and the line *a g*, will be the permanent set at that point. The distance from the base line to any point on the line *a g* will be the deflection, and will be made up of the elasticity measured above *a f*, and set measured below *a f*.

It is necessary at this point to give definitions of the terms which follow in italics. These were proposed in the paper "Aluminum and other Metals Compared," and were there treated more thoroughly than they can be treated here. The definition separates elasticity from the stress exerted to produce a change of shape, and from the work that a distorted body can perform while recovering its former shape. These definitions are proposed to meet the conditions as brought out by the use of "Keep's tests."

Elasticity is the property possessed by matter of regaining its original volume or shape after it has been distorted. Matter is *perfectly elastic* if it entirely regains its original volume or shape, and is *imperfectly elastic* if its recovery is only partial.

The diagram records *total deflection*, which is made up of *elastic deflection* above, and *set deflection* below the line *a f*.

Rigidity or *stiffness* is the ability of a material to withstand stress, and retain its original form. It is *perfect* when any stress which can be applied will not cause the material to change form.

The record or diagram of perfect rigidity would be the base line *a b*. *No rigidity* would cause the form of a material to change without limit on the least application of stress, and the record would be the line *a c* perpendicular to *a b* at the zero point *a*. With any ordinary material the diagram of rigidity would be a line *a f* starting at the zero point, and lying between the lines *a b* and *a c*.

The angle that this line *a f* makes with *a c* when all scales of the diagram are exactly the same as those here employed indicates the *relative rigidity*. This angle is measured with a transparent protractor, the center being on the zero point, the base line *a b* passing through the 90° mark, and the graduated arc described with a 2½ inch radius. The no rigidity line *a c* is the base of the protractor, and we read the angle through which the spring line passes as the *rigidity angle*. The reason we must use a protractor of this exact size is because nearly all spring lines are curved, and we must select some one point on the curve.

When the test bar begins to take set, the diagram leaves the rigidity line, and the point where the lines separate marks the *limit of proportionality*, and indicates the stress at which proportionality ceases.

We will now resume the description of the machine. Fig. 18 is a perspective view. When the weight is at zero the counterpoise balances the beam. The weight and the diagram paper are propelled forward or backward by steel cords attached to the drum and crank at the rear of the machine. The traveling weight is 100 pounds and the machine can exert a stress of 1,200 pounds. The arc at the forward end of the machine catches the beam when the test bar breaks.

To Test a Bar.—Run the weight to the left past the zero point, loosen the holder from the arc and raise the beam to the upper notch of the arc. Place the No. 1 square test bar in the supports, and tighten the end set-screws. Always place the bar so that its number shall be at the right hand and on the side towards you. This brings the gate marks down and on the edge away from you. With a wedge provided for the purpose clamp the pencil arm to the center of the test bar. Slide a strip of paper into the paper holder. Run the weight forward to the zero point, with the right hand raise the forward end of the beam out of the notch in the arc, and lower it until the pressure post bears on the bar. No stress is exerted on the test bar, and the pencil is therefore at its highest point.

With the right hand move the paper holder back and forth to draw a base line. Now attach the tightener to one of the pins of the paper holder, which push back slightly, to take up any slack in the cord. With a pencil make a mark over the point of the pencil *a* to represent the zero or starting point. See that the beam is free from the arc, and then run the weight out to the 300-pound mark.

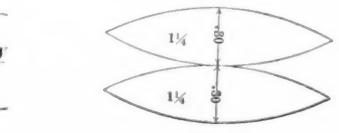


Fig. 22

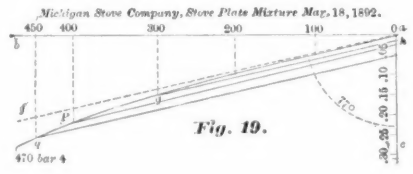


Fig. 19.

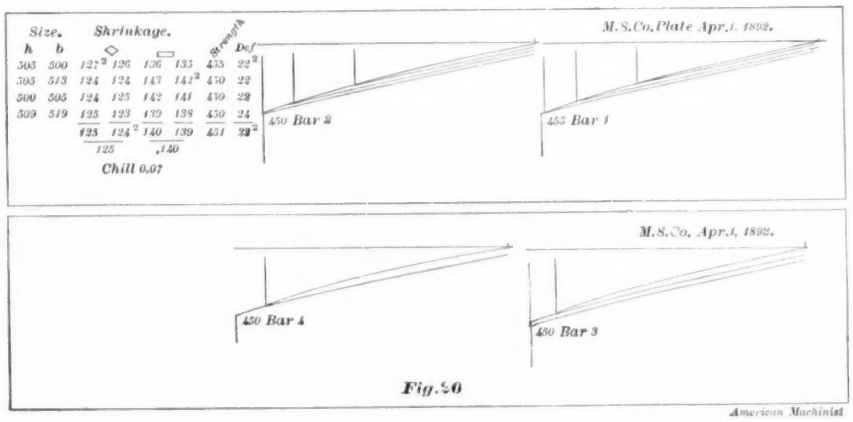


Fig. 20

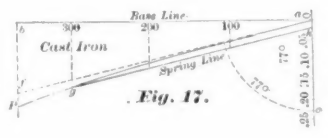


Fig. 17.

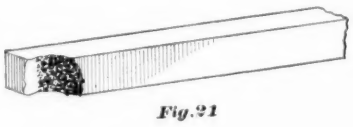


Fig. 21

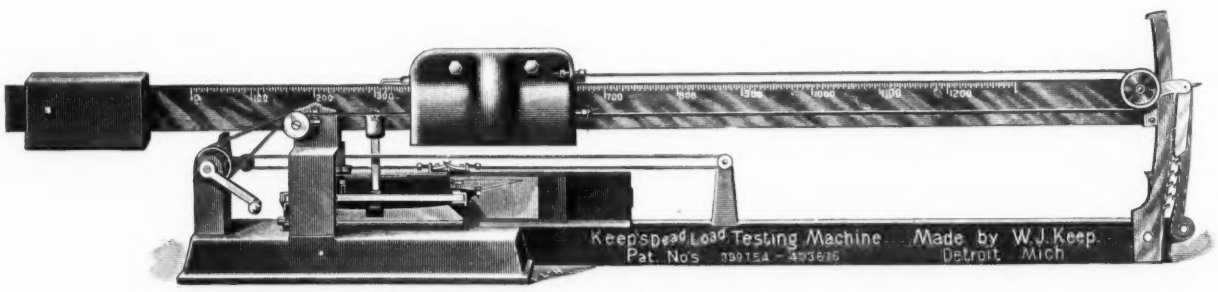


Fig. 18.

"Keep's Tests" for Cast-iron.

The paper moves one-quarter as fast as the weight. The stress is read in pounds avoirdupois on the beam, and recorded on the diagram at the point of fracture. Do not trust to measuring the stress from the diagram.

The machine is practically frictionless, and the diagram is a correct representation of the stress and strain.

Fig. 17 represents a diagram made by this machine. The base line *a b* is made by moving the paper horizontally while no stress is applied. If stress were applied, and the paper was not moved, the line *a c* would be described. If the test bar is a perfect spring, that is, if it is perfectly elastic, and the stress is increased, and the paper moved at a corresponding uniform rate, a straight diagonal *a f* will be described.

The distance from the base line *a b* to this spring line *a f* at any point is the deflection at that point.

If the bar is of gray cast-iron, or of any metal not perfectly elastic, it will bend faster than a perfect spring, and will take a set for each increase of stress, and the diagram will be the line *a g*.

Run the weight forward again to the 300-pound mark, and a new diagram *h g* is drawn. The first and last diagram meet at *g*. We may release and apply the stress from 0 to 300 as many times as we choose, and we find that the pencil always follows the line *h g*. Thus, although the test bar took set for every pound that the stress was increased up

Fig. 19 is a diagram from an exceptionally strong bar of the Michigan Stove Company's stove plate mixture. When the stress reaches 300 pounds step to the forward end of the beam, loosen the holder from the arc, raise the beam to the upper notch of the arc and close the holder. Return to the crank, with the right hand pull the pencil from the paper, and with the left run the weight back to zero. With the right hand lift the beam out of its notch and let it down until the pressure post rests on the test bar. Press the paper holder back to take up the slack of the cord and to bring the pencil under the zero of the diagram. The pencil will rest at h, and $\frac{a\,h}{5}$ equals the set of the test bar for 300 pounds.

to 300 pounds during the first application, the bar has become a perfect spring for all stresses less than 300. Its nature has changed, but the instant the stress exceeds 300 pounds the original character of the bar reappears, and the diagram beyond 300 is a continuation of the original diagram, and the upper line or diagram, taken as a whole, is exactly the same as it would have been if the stress had been continuously increased and had not been relieved at 300 pounds. After passing the 300-pound mark run carefully, watching the divisions on the beam so as to catch the reading at the breaking point. If the stress reaches 400 it is well to repeat the spring line. It is rarely that we can catch a spring line for 450. All spring lines from the same bar are parallel.

The spring line from a tempered steel bar will be a straight line, but the spring lines from cast-iron and similar metals which take set are slightly curved lines.

When the first bar breaks take the paper out and record the breaking weight at the end of the diagram; also record the number of the bar, the date of cast, and any other condition attending the test, or, what is better, put the diagrams on the same paper on which size and shrinkage have been recorded (see Fig. 20).

When this record has been made raise the pencil from the paper, run the weight to the extreme left, step forward and raise the beam to the top.

Raise the pencil to the highest point, loosen the wedge and binding screws, and take out the broken pieces of the bar.

With the hand break the No. 1 thin strip and put the ends of both square and thin bar containing the number in a paper or pigeon-hole marked with the number and date of the test. Break the remaining bars in the same way. It is well to make two or three diagrams on one side of the paper, and the rest on the other side, and if the rest of the record is on the same paper it is in a convenient form for preservation. In a foundry running on a uniform grade of work a test once a week is often enough, in which case the year's tests would be represented by 52 strips glued together at one end.

Fig. 20 represents the two sides of one of these record sheets greatly reduced in size, the actual length being 14 inches.

Referring again to the diagram, Fig. 19, a template may be made of the longest spring line, and it can be prolonged if necessary. This template can be placed parallel to the spring line, and with the zero point tangent with the first diagram at its zero point a new spring line $a\ f$ can be drawn. This divides all deflections into elastic deflection and set deflection, and all perpendicular distances between $a\ f$ and $a\ g$ are permanent sets. The angle of rigidity may be taken from this spring line $a\ f$. Note again that all results are *relative*, and never reduce results to so much per square inch cross-section, for the reason that practice shows that the internal structure of a bar has so much more to do with the strength than the slight variation in size, that a comparison of the sizes of the bars with strength does not show that this small variation exerts any influence on the results.*

We always record the actual strength of each of our standard bars. If an iron has a strength of 451 pounds "Keep's test," it means that 451 is the average of at least four bars broken by the dead load machine.

The difficulty with making comparisons with records of other machines is that they apply stress by means of a screw at the center of the bar, and then weigh the stress they have applied. This is not a gradual increase, and the bar often breaks during the application of stress and before the amount of stress is ascertained. In Keep's tests the bearings are always one foot apart, and the greatest accuracy is attained.

No oil should be used on these testing machines, as the dust from the bars will thicken the oil. If any part runs stiff we clean out the dust. It may sometimes be best to use a little flour of emery to make a part work smoothly, or apply plumbago.

The greatest strength for a single bar yet recorded in our stove plate castings is 470. The largest average for a set of 4 bars was 451 pounds. A bar from the ordinary mixture of Henry R. Worthington used for hydraulic machinery broke at 475 pounds. Above 300 pounds is more than the average of ordinary castings.

Large discrepancies in strength of bars may result from a blow-hole or cold shut in the fracture, or from a corner of a bar not having run full, in which case it is not necessary to include the result in making up the average. Generally, however, a study of the fracture under a lens will not reveal any reason for the low strength.

CHILL.—The surfaces of the yokes that form the ends of the mold chill the ends of the test bars. The yokes do not affect the test bars, except at their ends. By breaking the end of a test bar lengthwise the depth of the chill can be measured. Lay the end of one of the broken square bars upon an anvil. Place the point of a cold chisel (Fig 21) a little behind the chilled portion, and a blow from a hammer will split off a side of the bar. By the eye decide where the chill fairly stops, measure its distance from the end in hundredths of an inch, and record this as the chill of the iron.

Iron for thin castings, like stove plate and light hardware, will have from $\frac{1}{16}$ to $\frac{8}{16}$ of an inch chill. In machine castings containing less silicon the chill will run up to half an inch at times.

Nos. 1 and 2 pig-iron often give bars with no chill.

GRAIN.—The character of the fracture is recorded as seen through a double convex lens, the two having together a focal distance of three-quarters of an inch, the diameter of the lens being $1\frac{1}{4}$ inches (Fig 22). We have obtained better results from this combination than from any other lens.

What has now been described is the ordinary foundry test. It may seem too precise, but having started quite a number in the use of this test, we know how hard it is for a beginner to realize what serious errors creep in by making slight changes; also that the ordinary foundryman is not used to accurate methods.

We would advise that each one should become accustomed to what we have described before he attempts anything farther. Nothing more is needed for ordinary everyday practice. For testing mixtures of iron that are supposed to run regular, select one day each week, and have four pairs of bars poured from the center of the heat, ground, measured for size, shrinkage and chill, determine strength, and record all on one sheet of diagram paper, together with the mixture of the iron, unless a book is kept for a record of mixture. Take a test also the day before a change is made in the mixture. This, with the hints given in the paper on "Silicon in Foundry Mixtures," will enable a foundryman to do almost anything he wishes with his iron.

*The formula that the strength varies directly as the square of the height of the test bar, directly as the breadth, and inversely as the length, may be correct for bars where the structure is the same in each, but from the fact that the grain varies with the size of a cast-iron test bar the formula cannot give correct results in calculating the strength of a large bar from the ascertained strength of a small bar, or vice versa. We may, however, approximate the strength of a bar one inch square and one foot long by multiplying our results by eight; if two feet long multiply by four, or the strength of a bar two inches high, one inch wide and two feet long, by multiplying our results by 16.

LETTERS FROM PRACTICAL MEN.

Pump Valves—American Locomotives.

Editor American Machinist:

I send a sketch of an ordinary wing valve that gives a great deal of trouble from sticking, and this trouble comes from two causes. One of these is the making the wings straight.

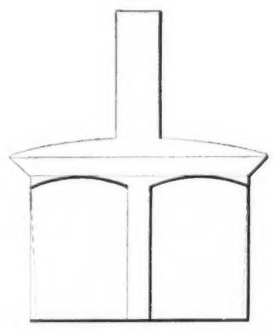
The writer does not have many vacations, but one time he got off for two days, only to learn when he got home that he was wanted at once at the mill, as something was shut down.

This was at night, and on arriving there I found the hydraulic work all shut down, and had been so for over a day, and every valve at the benches and accumulator had been taken to pieces, but nothing found out of the way.

It took half a day to put everything together again, and the machinery started up all right and ran for half an hour, when the same thing occurred again, which it did not take long to locate in a 3" check valve made like the cut, that had become stuck up. This had a pressure of 850 pounds per square inch on it, so it will be seen that its sticking showed what a slight wedging will do.

Having had considerable experience with that kind of trouble, it was taken out and the ends turned tapering, as shown in the dotted lines, which gives it a chance to work a little out of the perpendicular, and still bring it onto its seat straight.

When talking with builders of machines having this kind of valves, that they ought to make them tapering on the wings in the first place, they will tell you that the only proper way is to make them straight. I have seen valves of this style with stems $1\frac{1}{4}$" diameter broken when stuck in the above manner under high pressures.



Another trouble is, the valves as usually made have too high a lift, which gives them a greater chance to turn over to one side. It would be an exceedingly rare thing to find one that needed over $\frac{1}{4}$" lift, and in most cases $\frac{1}{8}$" would give smoother working valves—they would last longer, and be more satisfactory every way.

In your issue of November 10th, Mr. Booth says that a large wheel must have a proportionately large cylinder to turn it, is the only way his letter could have been read.

We seem to be agreed on this, and it brings it back to my first proposition, that "piston displacement by steam pressure determines the power that turns the wheel."

Mr. Booth wants to know "what surface contact has to do with adhesion anyhow"?

This would imply that he has not heard of our fellow-citizen from Boston, Mr. Swinerton, who ground facets on the faces of driving wheels to give them more surface contact.

The trouble with Mr. Swinerton's idea was that there must be a high place between the facets, so that the average surface was the same as a perfectly round wheel.

Whether the larger surface contact of the facets of Mr. Swinerton, or the sharp points between the facets that would "sink into the rail," according to Mr. Booth, if each could be obtained separately, would give the greatest adhesion, I will leave for these two gentlemen to decide.

Mr. Booth maintains that a locomotive with a large wheel ought to make as good a record in this country as in England. It will do better, because our atmosphere is drier, and the adhesion more perfect.

There is a reason, however, why a locomotive of one type will not do as well as that of another.

In Britain one sees a country that is finished. The common roads, the fields and the fences, whether it be the hedge rows of England or the stone walls of Scotland, all indicate an intelligent plan and labor that makes their island a thing of beauty, of which they are justly proud.

When their civil engineers went to surveying for railroads they found a country densely populated, and plenty of means at their disposal, so that they could construct roads with curves of long radius, and tunnel through hills and mountains.

The inhabitants were suited with light cars, provided they could run fast and be exclusive. When the motive power was wanted the mechanical engineer had to design a locomotive to run fast over these model roads, and he did all that could be desired.

If their civil engineers were to come here they would find a different problem. They would find an exceedingly shabby looking country as compared with their own, and where they had had ten miles to build, they would find here a hundred.

They would find but little means at their disposal, and a sparsely settled country to build through, and the principal outlook for revenue the hope that the road would induce people to build towns along the line. They would find all sorts of ground for a roadway, wide rivers and mountain ranges, with no money to tunnel; must bridge the former as best they could, and go around or over the latter. All this must be completed in the shortest space of time, sometimes a thousand miles in a year. When the mechanical engineer came to design the motive power he found many obstacles in his way. He found a public—after it had once got a taste—that demanded heavy and luxurious coaches which he must transport around short and frequent curves and over heavy grades. He found the population rapidly outgrowing the first attempts at transportation, and heavy trains were the result. He has had to design a locomotive that was suited to these special needs, and it seems to me that he is deserving of the highest praise for handling these trains with such ease. Not only this, but with his small wheels he has outstripped the world in speed, the Empire State having recently run ten miles at the rate of 95 miles per hour, while the train from Philadelphia to Jersey City on the Philadelphia & Reading Railroad, Friday night, November 18th, drawn by engine No 385, ran a mile in 37 seconds.

It is true that at the present time we have some roadways that will compare with England's models, but the weight of cars grows heavy, and the train must be heated by the locomotive as well.

Mr. Booth speaks of their six-wheeled trucks, but if he will examine the subject he will find that the six wheeled truck is as old here as brick arches in fire boxes.

W. E CRANE.

Conical Cam Rollers.

Editor American Machinist:

In your issue of December 22d Mr. Severance asks me to state "for what purpose" the cylindrical cam roller is "absolutely wrong." It is not at all difficult to do this. I have no hesitation in saying that it is "absolutely wrong" for use as a "kedge anchor" or a "cambric needle." Possibly if he should apply his practical experience, supplemented by his imagination, to the investigation, a few other "purposes" might suggest themselves for which it is unfitted. Judging from the emphasis which Mr. Severance puts upon the "friction between the [conical] roller and the shoulder of the stud upon which it is mounted," one would infer that he is opposed to the use of bevel gears, and would prefer the ancient "crown wheel" and "trundle" in their place. The "conical cam roller" is only a particular case of the "bevel wheel," in which the pitch and length of teeth are infinitely small.

We should also infer that if he purposed to support a turn-table on anti-friction rollers, his love for the "cylindrical cam roller" would lead him to employ that form. If so, he would find his "tried and trusty, though faulty friend" (this "friend" is at the same time a saint and sinner) neither a "thing of beauty" nor "a joy forever," for it would go promptly where all good sinners go, and remain there "forever and aye."

W. F. DURFEE.

A press dispatch from Utica, N. Y., says: It has been ascertained that the fire which occurred in Greene, Chenango County, on Christmas morning, and by which a loss of $28,000 was entailed, was caused by the crossing of an electric light wire with a telephone wire in Binghamton, thirty miles away.

The heavy current of the electric light wire is said to have burned out switchboards on the telephone line between Binghamton and Greene, and also in some towns north of Greene. The telephone wire ran into the building where the fire started in Greene.

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NEW YORK, JANUARY 12, 1893.

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Some Coal Combine Testimony.

The people through their representatives are continuing to make life something of a burden to those who are prominently connected with the coal roads combination, and it is evident that some of the testimony which is being brought out is proving very annoying to them. It ought to do a great work in educating the people to an understanding of the extent to which they are placed at the mercy of these combinations, however, if it does nothing more than this.

Mr. John C. Haddock, an independent coal producer, whose mines are on the line of the Delaware, Lackawanna & Western road, recently testified before the House Committee that the combination's method of dealing with him was to restrict the number of cars furnished for the shipment of his coal, and to charge him exorbitant freight rates—so exorbitant as to seriously interfere with the profits of his business, and then try to buy the production of his mines with these high rates for transportation as a principle factor in fixing the rate per ton offered for the coal at the mines. In restricting the number of cars furnished, the road violated its contract with Mr. Haddock, as he had succeeded in establishing in court. Covered cars such as the road used for shipping its own coal west, Mr. Haddock had never been able to obtain for his use at all. Mr. Haddock said:

"The coal-carrying roads are trying to squeeze out independent producers by putting up freight and then offering to buy at a higher price at the mine than the producer can net at tide water after paying this excessive freight. . . .

"Under the present combine, the coal railroads monopolize the trade along their lines and freeze out the producers. I know personally of a case in point. A friend of mine got a quotation from me for a large quantity of coal at the mine, and then got a freight rate from the Delaware, Lackawanna & Western Railroad. The coal was to be delivered at Binghamton. My friend suddenly lost the sale, and later he found out that the railroad, the common carrier, had sold the coal to the party for the freight rate which it had quoted to my friend."

In relation to the demand for coal, the witness said that "the capacity of the market was regulated largely by the price of coal. The market would take more coal at a lower price," thus sustaining our previously expressed view that no one knows what is the "legitimate demand for coal" until it is mined and transported by competitors and the price fixed by competitive methods, so that the desire for and the needs of the people to use coal can be fairly measured against the cost of its production.

The Wire Gauge Muddle.

A contemporary in discussing the proposition to adopt a new wire gauge, or to designate sizes of wire in decimals of an inch, seems to conclude that there is some special value in having a regular, or "logical" arrangement of sizes, *i. e.*, that the increase of sizes should be represented by a straight inclined line, or by some regular curve. We fail to perceive why this should be so, and so far as we can see there is no use whatever in adopting any new gauge in order to designate sizes in decimal parts of an inch. The demand of wire and sheet-metal users is not that curves representing the increase of sizes from one number to the other shall be regular, or beautiful to the eye, but that sizes which are actually needed in practical operations shall be available, and that, when a certain size or number is mentioned or ordered, that size or number shall mean precisely the same thing to all concerned.

In order to do this, it is not at all necessary, so far as we can see, that a new gauge should be devised, but only that some well known gauge now in use which gives the required range of sizes, or some combination of gauges which will give the desired range be adopted, and the actual sizes corresponding to its numbers definitely determined and used in ordering, or in any way referring to the wire or sheet-metal. And, so far as we can see, there is no virtue whatever in any particular "number," as distinguished from the designation of its equivalent size in decimals of an inch. For instance, if wire $\frac{1}{8}$" diameter is talked about, it is just as easy to call it number 500 (thousandths being understood), as it is to call it by any arbitrary number which may or may not indicate to those who happen to be acquainted with such matters jnst what the size really is. Three eighths wire would then be number 375, $\frac{5}{16}$" wire would be number $312\frac{1}{2}$, $\frac{15}{64}$" wire, if there were such a size, would be number $234\frac{3}{8}$, and so on, the number always indicating directly and absolutely the actual diameter of the wire or the thicknesses of the sheet in thousandths of an inch, which mean precisely the same thing in every shop and in every country.

Users of wire and of sheet-metals, acting in conjunction with the manufacturers of these articles, have adapted the supply to the demand and the demand to the supply, in the matter of sizes or gauge numbers. So far as we can see there is no need whatever to disturb this adjustment in order to avoid confusion, but only by common consent to designate sizes in decimal parts of an inch, instead of by arbitrary numbers. If every man who orders wire or sheet-metal will simply determine the diameter of the wire or the thickness of the metal he wants, and then so designate it in his order, with the limit of variation allowable, the problem of the wire and sheet-metal gauge will, we think, be in a fair way of solution, and the committee of the A. S. M. E. who is to consider and report upon the matter will do well to avoid the attempt to devise a new gauge. There are enough gauges—too many.

Abuse of Patent Rights.

Mr. J. C. Clayton, of New York, in a published letter calls attention to the fact that our present patent system is endangered by the character of some of the monopolies which have been built up under it. He refers particularly to the recent decision in the incandescent lamp suit, in which the Edison patents were again fully sustained, which decision seems to practically create or permit the creation of an oppressive monopoly, by prohibiting other manufacturers from carrying on business. The court, however, in the decision gives permission to the defeated parties to apply for a dissolution of the injunction if the Edison people refuse to furnish the lamps at a reasonable price. Mr. Clayton thinks the courts may well go a little further than this, and, where industries have been built up that compete with each other, and an injunction will result in the closing of all but one establishment, destroying the competition, then the right to manufacture and make use of the basic device should be granted to the defeated party under restrictions which will protect the rights of all concerned, including those of the public, and so that the other patents controlled by the defeated firm may be made use of in connection with the basic device. The fact is pointed out that it is better that courts of equity should rule liberally in these matters, and with the interests of the public in view, rather than that injurious legislation should be enacted—legislation which would injure or curtail the rights of all inventors and patentees, regardless of circumstances or merits.

Nothing can be more certain than that the sentiment in opposition to monopolies of all kinds is gathering force. The people have been willing to grant to inventors a monopoly of their own productions for a limited time, on conditions; but it is quite certain that if the privileges granted under patent papers continue to be abused as they have been in the case of the telephone, for instance, injurious, and, we fear, unjust legislation will be enacted. One bill now pending in Congress proposes to reduce the term of all patents to seven years, and, though we are not informed in the matter, we presume this bill was introduced in answer to a sentiment growing especially among the farmers, that patent rights are bad things *per se;* the fact that the privileges granted under patent rights are in many cases grossly abused being solely responsible for this growth of an erroneous idea.

The representatives of the American Brotherhood of Steamboat Pilots, Harbor 15, and the Marine Engineers Benefit Association No. 35, San Francisco, Cal., held recently a meeting at which resolutions were adopted looking to affecting the probable action of Congress as to the admission to American registry of foreign vessels, notably the City of Paris and the City of New York, these vessels being still under command of alien officers. Strong grounds were taken against placing such officers in command of vessels that were supposed to be in time of peril an addition to the American navy, making it apparent that the pilots and engineers, American born, will strongly object to the employment of any such officers, firmly believing that American vessels, or foreign vessels admitted to American registry, shall be manned by American-born officers.

We are not sure but they are right in this; in fact, it looks as if they were right. In any event they will make a hard fight against any action of Congress looking in a contrary direction.

The grand idea in such admission of vessels to American registry is, after all, and put it as we may, that in case of war they shall assist the American navy, but the idea of these men who oppose such registry under the circumstances named is that no officer who might find himself placed in command of one of these vessels would fight against his own country. Nothing is more natural than this. We think the pilots and engineers of San Francisco are right in their objections to the proposed law.

In no branch of the applied arts has greater skill been shown than in the construction of machine tools. In no country in the world has that skill shown a greater development than in America. It does not follow from this that we say we make better machine tools than are made elsewhere, but it is a fact that no tools have been copied so extensively in foreign countries as American tools have been copied. This may not be much to say, but it does follow from this that we are doing work here which is favorably thought of elsewhere. American manufacturers are sometimes slightly jealous of the copying of their tools in foreign countries. We think that it is a credit to them that they are so copied. We are always glad to know that somebody somewhere in Europe is trying to produce a tool as made in America, and at the same time we have little fears that they will be able to beat the American manufacturer on his own ground.

It is stated that some of the directors of the Connecticut River Road, who, acting with their fellow directors, had arranged for the leasing of the road to another corporation upon such terms that all the stockholders would have benefited in proportion to their holdings, went out under the pretense of carrying out the plan and sold their own stock to a third corporation, enabling this corporation to control the C. R. road and presumably to buy the stock of the remaining stockholders not in the deal, at its own price. We suppose that if a conductor or a workman employed on the C. R. road were to steal any of its property he would be prosecuted by the directors, who would feel themselves to be very much superior to him morally; but we say that any common thief is as respectable and honorable as men who would do the thing described above.

George Frick.

George Frick, who recently died in Waynesboro, Pa., aged 66, was one of the notable persons of the town, in a mechanical sense, and highly respected by the citizens. The great Frick works at Waynesboro bear evidence of his ability, and the citizens of the town know of his integrity.

An English paper states that F. Kuhn & Co., of 65 Bosingwell street, London, have introduced a file handle made of specially

prepared pulp—a handle which is comfortable for the filer, does not split when a file is driven into it, and does not shrink and allow the ferule to fall off.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(7) L. S. G., Cleveland, O., writes: Kindly let me know in which issue of your paper the sizes of iron pipes, number of threads and length are given. I have looked as far back as 1884, but have been unable to find it. *A.*—You will find these sizes given in our issue of March 19, 1887 and April 19, 1891.

(8) F. W., Fort William, Canada, writes: Please inform me through your columns as to the extent to which electricity is used in working iron. Can a large surface be heated? Can general forge work be done by electricity? *A.*—Electricity is frequently used for welding iron, and experiments have been made with it in forging iron, but it is not generally used for this purpose.

(9) D. D., Phillipsburg, N. J., writes: Kindly inform me through your columns in regard to the following: Which method is the more satisfactory, when there is plenty of exhaust steam—to heat a building by live steam and return the water due to condensation to the boilers by trip, or to use exhaust steam from engine and not put the waste water in the boilers, but heating the feed water by exhaust steam in both cases? *A.*—We should prefer to use the exhaust steam for heating the building.

(10) S. C. G., Bath, Me., writes: Kindly inform me what is the composition of rubber cement. *A.*—There are different compositions of rubber cement, depending on the purpose for which it is to be used. For rubber belts, etc., the following may be used: Carbon bisulphide, 5 ounces; gutta percha, 5 ounces; caoutchouc, 10 ounces; fish glue, 2½ ounces. After it is applied and has dried the excess can be removed with a wet knife. You will find other receipts in the book entitled, "Rubber Hand Stamps, and the Manipulation of Rubber," by T. O. Sloane.

(11) X. Y. Z., Blacksburg, S. C., writes: Please let me know through your Question and Answer columns some successful arrangement for burning wood in a locomotive having an extension front and straight stack. *A.*—You do not need any special arrangement for burning wood; this can be burnt in any locomotive with an extension front correctly designed for burning coal; there are so many extension fronts in use that any railroad man should have no difficulty in obtaining the principle of design and dimensions. Of course, for burning wood you will not need rocking grates or such types as are generally used for burning coal - a plain stationary grate will answer the purpose.

(12) A. J., Lowell, Mass., writes: Please inform me where I can find a detailed description of compound and triple expansion engines. *A.*—You will find illustrations and descriptions of compound engines in our issues of September 10 and November 12, 1891; and triple expansion engines are illustrated and described in our issues of November 24, 1880, and April 30, 1891. These are only a few of the many compound and triple engines illustrated and described in our columns. The series of papers treating on the design of these engines, by James Tribe, which were commenced in our issue of August 20, 1891, may be of assistance to you. For a very elementary work, we would refer you to the "Text book on Steam and Steam Engines", by Prof. A. Jamieson.

(13) J. H. B., Kingston, Canada, writes: Suppose a wheel lathe is running at 20 revolutions per minute, turning off a pair of tires 63 inches diameter, should not the lathe run at least 1¼ times as fast in turning a pair of 32-inch tires? My reason is that, as the rim speed in the first instance is, say, 3,940 inches per minute, that it ought to equal it in the second instance to get the same results. The only explanation I can get for not running it faster is the tool will not stand it. If it can stand it in the first instance, why not in the second? It seems to me it is doing no more work. *A.*—Your reasoning is correct, provided that all the conditions are the same in both instances; if metal in the tire in one case is harder than in the other, of course the speed will have to be slower in the former case than in the latter.

(14) W. F. G., Brockton, Mass., writes: I have considerable trouble with my boiler. I do not get draught enough; I run a blower all the time, but the smoke in the fire room is so thick that I cannot see the steam gauge; I am thinking of exhausting into the stack; the exhaust pipe is 5 inches in diameter. Please let me know how to arrange it to give the best results, or should I have the stack built higher? *A.* We should advise to have the stack built higher, and thereby remove the cause of the trouble Although the exhaust is sometimes run into the chimney, we do not advocate the practice; but if you should insist upon doing so enter it about 1 foot above the level of the upper row of flues in the boiler, and arrange the exhaust nozzle so as not to allow the steam to impinge against the sides of the stack, but to direct the current along the center line of stack.

(15) D., Hartford, Conn., asks: Will you please tell me how to calculate the angle of the sides of a square thread tool to cut a tap of rapid pitch? *A.*—Find the diameter of the tap at the middle of the height of the threads, and multiply this by 3.1416 to get the circumference at this point. Divide the pitch of the spiral, *i. e.*, the distance from the center of one thread to the center of the next in a single-threaded tap, by this circumference, and the result will be the tangent of the angle. Then find the corresponding angle in a table of natural tangents. This angle when so found represents the angle of the center line of the cutting portion of the tool measured from the vertical, and the sides of the tool should be given the required clearance besides this, so that the angle on the advance side of the tool will be slightly greater, and that on the rear slightly less than the angle previously determined.

(16) T. P., Brooklyn, N. Y. writes: A. claims that by cutting the grooves of a tap with the cutter as shown in Fig. 1, he gets much better results, and a clearance without backing off the threads. B claims that with the cutter in position as shown in Fig. 2 he gets the same results, but that there is no clearance in either case without backing off the threads. Which is right? *A.*—No actual clearance is secured in either case without backing off the threads, and it seems as though this ought to be self-evident. But there may be, and probably will be a

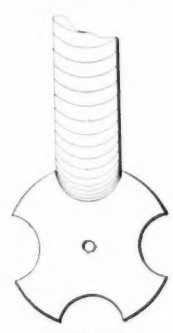

Fig. 1.

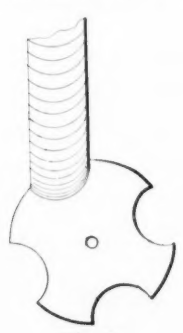

Fig. 2.

difference between the two positions with regard to throwing up a burr in the threads at the cutting edge, *i. e.*, position 1 will make the burr about equal at the front and back of the land, while Fig. 2 will tend to make the burr smallest at the cutting edge, and largest at the back of the land. This in the case of small taps, where the burr may not be removed before hardening, might lead one who used the taps to the opinion held by A., because this burr may act temporarily as a clearance. But, if so, it is a false clearance, and does not last long, unless the milling cutter is much duller than good practice allows.

(17) A. H. K., Allegheny City, writes: A. claims that a plug of given size will not pass through a ring of the same size. B claims that it will. Who is right? *A.*—It is not certain who is right. We believe that Sir Joseph Whitworth claimed that a plug and ring gauge of precisely the same diameter, made of hardened steel, could not be put together except by the use of sufficient force to stretch the ring or compress the plug, or both. We are not aware, however, that Whitworth ever proved this, or that there can be any proof of it one way or the other. A plug and ring gauge can be made to fit each other so closely that they cannot be put together by hand dry, nor with any other lubricant than that which is of very fine quality, and even then the plug must be very skillfully inserted, and very quickly withdrawn without twisting it, or it will stick so tight that it will have to be driven out. Such a plug and ring are at least very nearly the same size, and, so far as we know, there is no way of proving by measurement that they are not precisely the same size, nor even that the ring is not slightly smaller than the plug, the metal being possibly slightly compressed or stretched as they are put together.

(18) C. H., Watsonville, Cal., writes: We intend to put in a 4 horse power gasoline engine to pump water for irrigating purposes. The water is to be raised to a height of 15 feet. The pump is to be of the centrifugal type; what size of pump will we require? Some parties say that one with a 3-inch suction and 3 inch discharge is sufficient, and I say that it should have a 5-inch suction and 5-inch discharge. Who is right? *A.*—We believe your advisers are correct; in our opinion the engine will not handle a pump with a 5-inch discharge, and raise water to height of 15 feet. 2. What size of a pump will be required? *A.*—One that will raise about 600 gallons per minute to the required height. 3. I figure that the water will have to pass through the 3 inch pipes at the rate of about 2,904 feet per minute; is this right? *A.*—We do not see how you can get such a high velocity. The engine cannot run satisfactorily a pump that can discharge more than 600 gallons per minute. Each gallon contains 231 cubic inches, and 600 gallons contain $231 \times 600 = 138{,}600$ cubic inches; this product divided by the area of 3 inch pipe, which is equal to 7.06 square inches, gives a speed of $\frac{138{,}600}{7.06} = 19{,}631$ inches per minute, or $\frac{19{,}631}{12} = 1{,}636$ feet per minute.

(19) R. K., Columbia, S. C., writes: Please inform me in regard to the following: We have three shafts to make of soft steel; they are 4 feet long, 3 inches diameter, with a collar at 6 inches from one end; the other end is tapered and threaded The end with the collar has to be hardened. Please give me a good way for doing this. *A.*—You can case-harden the end by melting a mass of cyanide or prussiate of potash, making a red hot bath of it, in which the end to be hardened is heated for any desired length of time, and when sufficiently heated it should be cooled either in oil or water. Another way to use these materials is to heat the end in an open fire, and sprinkle it with or dip it in the material, which for this purpose should be in the powdered form. The end may be cooled as soon as the potash melts, or it may be laid back in the fire to soak, and the dipping and soaking repeated until all the benefit possible is derived from the process, after which it must be quickly cooled. If there is no objection to heating the whole length of shaft, its end may be hardened by the regular case hardening process; that is, place the shafts in a box and pack the ends which are to be hardened by carbon-yielding material, and the remainder of the length by old material which has been previously used for case-hardening, and from which all the carbon has been extracted. The carbon-yielding material must be selected for its fitness; it is determined by the quickness of the process, and depth of hardening required; charred leather for from 1 to 3 hours; fine and then coarser granulated bone, as the period increases, from 1 to 24 hours; and hard wood charcoal for longer periods, with mixtures of these for any gradations wanted. The whole is then heated in the usual way, as described in our issues of May 22 and June 5, 1890.

(20) F. H., Dubuque, Iowa, writes: I wish to make a change in two multiple cylinder steam pumps from high pressure to compound condensing, and should like to have your opinion as to the best method of doing it. One of these, say number 1 pump, has six steam cylinders 24 inches diameter and 20 inches stroke, and six water cylinders 20 inches diameter and 20 inches stroke. The valves cut off at ⅞ of the stroke; piston speed, 50 feet per minute; the maximum pressure on the pump cylinders will not exceed 50 pounds per square inch. How will it answer to use one of the steam cylinders for high pressure, say at a gauge pressure of 75 pounds, exhausting into the five 24 inch cylinders, the latter being connected to a condenser? What would be the mean effective pressure and the terminal pressure in the high and low-pressure cylinders? Would it make a better combination to use two of the 24-inch cylinders for high pressure and the other four for low pressure, as with this combination the cranks could be set so as to obviate the necessity of a receiver? What would be the mean effective pressure and the terminal for this combination? *A.*—We should use two cylinders for the high pressure, and four for low-pressure cylinders. For computing the mean effective pressure and terminal pressure within a reasonable degree of accuracy we must know the piston clearance, which you have not given. 2 Pump number 2 has four high-pressure cylinders 17 inches diameter, 30 inches stroke, cutting off at ⅞ stroke; piston speed, 50 feet per minute; four pump cylinders, 17 inches diameter, 30 inches stroke, with a maximum pressure of 20 pounds per square inch. The combination I had thought of was to use one 17-inch cylinder for the high-pressure and three for the low-pressure cylinders; or another way, to reduce the size of two of the 17-inch cylinders to 12 inches diameter, and have the other two for low pressure. Both pumps are controlled by throttle valves operated by the engineer. *A.*—We should use one 17-inch cylinder for the high-pressure, and the others for the low-pressure cylinders.

BUSINESS SPECIALS.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

$10 Countershafts. A. D Pentz, Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

New lists of cutters. Brown & Sharpe.

Norway Rivets. Evans & Robertson, Cincinnati, O.

6 Spindle Turret Drills. A. O. Quint, Hartford, Ct.

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Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Standard Tool Co.'s Twist Drills.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

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Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg Co., cor. Canal and Washington Sts., Chicago, Ill.

Combination Gear Cutters in stock. Vertical Miller, Drill and Slotter in one machine, worth its weight in gold. R. M. Clough Tolland, Conn.

We electrotype illustrations and advertisements for manufacturers. Prompt and thorough service. Send for estimates. A. Mugford, Hartford, Conn.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
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S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 208 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

English and American Practice.

In its issue of Dec. 9, the *Mechanical World*, of London, reprints Mr. Arthur's article on "American and British Workmen and Machinery," commenting upon it as follows:

Several months ago a paper by Prof. John E Sweet appeared in our highly-esteemed contemporary, the AMERICAN MACHINIST, entitled "American Boasting." Prof. Sweet's contribution was a mild tirade on the national infirmity of our transatlantic cousins, and although somewhat overdrawn, it could not we think, fail to produce an all-around salutary effect, although it must be admitted some of the statements made were of a nature calculated to wound the pride of the patriotic American engineer. However, his feelings will now be soothed by perusing another article on "American and British Workmen and Machinery," which lately appeared in the journal above referred to, and which we reproduce in full in another part of our impression. We believe the impartial reader of this contribution will admit that it contains much food for thought, not only for the British workman, but for the foreman and manager also. The remarks concerning American and British methods of locomotive construction are especially pertinent, and, making every allowance for the "national pride" of the writer, it cannot, we think, be denied that there is much sober truth in his comments. Mr. Arthur, however, is nothing if not American, and, in comparing the English with the American locomotive, appears to readily sacrifice his veracity in order to make "points" against the English engine. Thus, he remarks that the English locomotive is a "wonderful little machine for drawing railway carriages,

but when you bring it to America it is practically useless for drawing railroad cars." Now we would most respectfully point but that to draw railway carriages is precisely the duty our engines are built for, and so long as they will do this at a speed and with an economy which will compare most favorably with those of any other nation, there is not much reason to find fault with them because they are not also suitable for drawing lumbering railroad cars over the rough American tracks. From Mr. Arthur's remarks that "both driver and fireman stand openly in the weather," we are inclined to think that either he saw very little of the English locomotive, and nothing at all of a modern express engine, or else that he is willfully misrepresenting facts. Of course, the protection afforded our drivers is not on a par with the very commodious cabs used in America; but then, fortunately, we have not quite the same delightful possibilities in the way of weather to contend with, although we may have more of it. In comparing the methods adopted in British workshops, Mr. Arthur appears to be more in his element, and there is undisputably much to be said for his side of the argument. For instance, it is impossible to ignore the fact that the slotting machine is far too frequently used, and that, too, in a most indiscriminate manner, in our workshops. The merits of both vertical and horizontal spindle milling machines, however, are gradually forcing them to the front here, in spite of the "obtuseness and stolidity" which characterize us as engineers, and the day is not far distant when even in this "effete country" the slotter will be relegated to its proper place in the workshop. It is impossible to deny the truth of many of Mr. Arthur's remarks upon the condition of the average British workman, although even here his tendency to exaggerate is often painfully apparent. All things considered, however, we are inclined to thank Mr. Arthur for his plain statement of the impressions he has obtained of British engineering methods and workers. To see ourselves as others see us offers an opportunity for putting our house in order, and, rightly regarded, such a contribution should teach us a useful lesson, though it can be of little use to our American cousins, if they are such wonderful people as Mr. Arthur would have us believe.

This probably relieves us of the necessity of defending ourselves for publishing Mr. Arthur's article—for which, as our readers know, we have been criticized.

It may be proper to add, for the comfort of those of our friends who think we have gone too far in the matter, that we have in hand communications from men now working in this country who were first trained as mechanics in England, and whose criticisms of English practice are, to say the least, as severe as anything Mr. Arthur has said. We are not responsible for their views, and may not publish them until we are again informed by *The Engineer*, of London, that Americans must go to England when they want real excellence in tools.

By the way, regarding this matter of the tools built in England for Carnegie, Phipps & Co., Mr. John Richards says, in the December number of *Industry*, that Mr. Andrew Carnegie's last purchase of machine tools in England

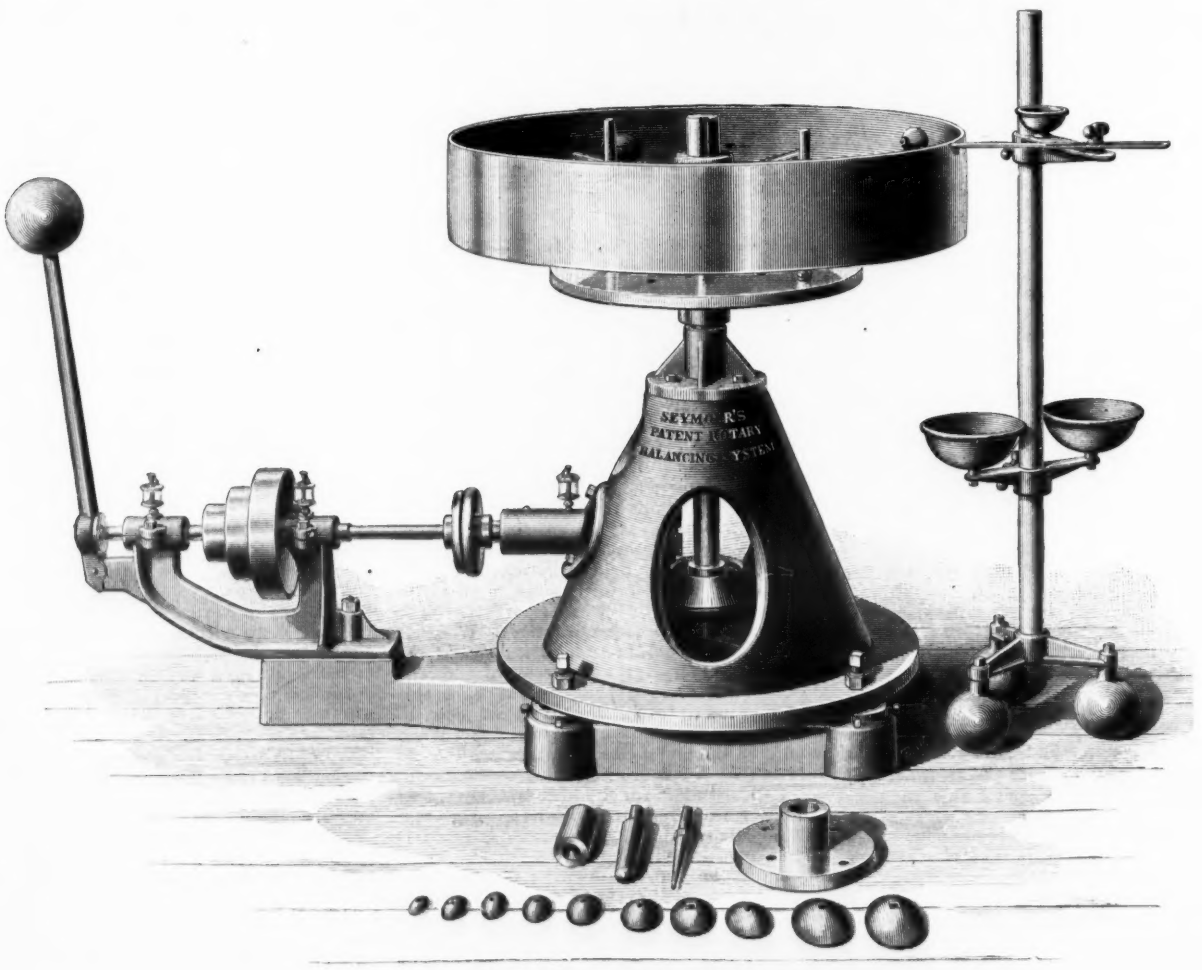
"Is a large planing and slotting machine made for him in Leeds, England, and, for anything we can detect, in a recently published drawing of the machine, having no other than the most simple elements of machine tool practice; has not even modern belt shifting and reversing gearing for the platen movement and slot levers for the vertical or shaping movement. The feed motion is operated by tappets on the table, a method no tool maker in this country has employed for twenty years past. The table is driven by two screws receiving their thrust, so far as can be seen, on bare collars, and which, by known rules of construction, can never work in unison with rigid connections of nuts and so on, and only when independently driven. We are pretty well acquainted with English machine tool practice, and concede its merits, except in planing machines; for these it is as bad as can be."

John Richards is not only a recognized authority on machine tools, but is well acquainted with the practice of both countries' and is probably little, if at all, influenced by prejudice in such a matter.

FOUNDRY LADLE.

Foundry Ladle.

With the increasing demand for large castings many foundries are forced to look about for better ladles for handling iron than were formerly necessary—ladles which will hold iron securely and safely, and be convenient to handle with the least possible force. By the accompanying engraving we illustrate a ladle of 14,000 pounds capacity, which can be tipped by the worm gearing shown at the side, or directly by the squared shaft at the pivot, when the worm is disconnected. Using the worm gearing, it of course holds any given position as long as may be desired. These ladles were first constructed by the Robert Poole & Son Co., of Baltimore, Md., for use in their own foundry, and they are now prepared to furnish them to others of any desired capacity. They are made of the best obtainable material, and are intended to be the best possible foundry ladles.



SEYMOURE'S ROTARY BALANCING MACHINE.

Seymoure's Rotary Balancing Machine.

We frequently receive from our readers inquiries as to the best method to pursue in balancing rotating parts of machinery, such as cones and cylinders that are long in proportion to their diameter, so that both standing and running balance will be secured. The machine which we now illustrate is designed especially for such work in addition to the ordinary balancing done on pulleys, and for these, where the width of face is considerable, it enables a better job to be done than can be done by the usual arbors and straight-edges, because it enables the balancing weights to be placed the proper distance from the edge of the pulley to secure true running balance as well as standing balance, which latter is all that can possibly be secured by the arbor and straight-edge method.

As will be seen by the engraving, the machine consists essentially of a cast frame of conical form, adapted to be leveled upon its base by the set-screws shown, in such a way that the vertical shaft shall be really vertical. This vertical shaft is supported in suitable bearings, and is driven by friction gears from a horizontal shaft on which is a cone pulley for driving and a friction clutch arranged to be operated by the weighted lever, which, thrown in one direction, holds the clutch in contact, and in the other holds it out of contact.

The upper end of the vertical shaft is fitted with a face-plate in which are two driving studs, as shown. The end of the spindle is also bored tapering, the same as a lathe spindle, and is fitted with a center in the same manner.

The pulley, cylinder, or other thing to be balanced is fitted with a plug which fits the bore, and has at its lower end a conical recess into which the point of the center enters, the plug being placed at such a height that the pulley is suspended upon the center from a point slightly above its center of gravity. The heavy side of the pulley will then fall nearest the face-plate, and a standing balance is secured by attaching weights to the rim in the usual manner. The machine is then started in motion, and as soon as up to speed the clutch is disconnected, allowing the pulley to revolve by its momentum so that it is undisturbed by the action of the driving studs; marks then made by chalk or otherwise on the rim as it revolves indicate how the weight or weights are to be moved across the rim to secure a running balance, this movement of them not, of course, interfering with the previously established standing balance, the fact being that a running balance necessarily involves a standing balance, though a standing balance does not necessarily involve a running balance.

The stand shown for holding tools, bolts, marking materials, etc., and to supply a rest for marking, goes with the machine; also plugs, centers and a set of metal patterns for balancing weights, etc. In practice the machine is found to enable proper and good balancing to be done as rapidly as improper balancing can be by the usual methods. The machine weighs 1,350 pounds, occupies a floor space 5 feet by 3 feet, and is built by the Defiance Machine Works, Defiance, O.

Science is classified knowledge. This is the best expression in the way of a definition of the term that we have ever heard.

MANUFACTURES

The General Fire Extinguisher Co., of New York City, has been incorporated.

The Waldron Construction Co. has been incorporated at Charleston, W. Va.

The Giant Electric Motor Co., Portland, Me., is to increase the capacity of its shop.

A new weaving-mill is to be erected at Mapleville, R. I., for making worsted goods.

It is said that the Lockport Felt Co., Newfane, N. Y., will build an extension to its mill.

The Essex County Pulp Co. has recently broken ground for a factory at Ticonderoga, N. Y.

An electric light company has been organized at Chestertown, Md., with a capital stock of $20,000.

The City and Suburban Railway Co., of Baltimore, Md , will erect an electric power station that will cost $500,000.

Charles W. Bradford, of Clinton, Me., has a new invention, and a stock company has been formed to handle it, with a stock of $500,000.

Citizens of Ashland, Wis., have recently given Wilhager & Weiland a site and a bonus of $10,000 to aid in the construction of a pulp-mill.

Fair, Williams & Co., of Ottumwa, Iowa, write us that they have purchased the Western Machine Works of that place, and propose to consolidate the two establishments.

The Pittsburgh (Pa) Typewriter Company has been granted a charter. It is understood the new concern proposes to engage in the manufacture of typewriters of a new design.

William A. Harris Steam Engine Co , Providence, R.I., send us an instructive catalogue of the Harris-Corliss engine. It is finely illustrated, showing the recent practice of the company.

The Sanford Mills Company, Sanford, Me., will build immediately a new horse-blanket mill on the site of the one burned Thanksgiving day. The mill will be in operation in seventy days.

The Vulcan Works, South Chester, Pa , have been incorporated, capital $50,000, for manufacturing of iron or steel, or both, etc.; incorporators, W. H. Green, Wm. H. Green, Jr., Margaret J. Green, South Chester, Pa.

Muncie (Ind) Iron and Steel Company has been incorporated, capital $50,000, for the manufacture and sale of merchantable iron and steel, etc.; incorporators: John Griesheimer, Edward Tuhey, Richard McGauley, all of Muncie, Ind.

The large iron and steel works in Durango, Mex., has been purchased by Collis P. Huntingdon, president of the Southern Pacific Railroad, who has also bought the very large iron mountain near by. He intends to make the plant the largest on the continent.

We are in receipt of the latest catalogue of Athol Machine Co., Athol, Mass. This company build a large variety of tools and machines, the scope of which will be better understood by writing for their catalogue, which, we believe, will be sent upon application.

The Lansberg Brake Co., of St. Louis, have just received an order for three thousand complete brakes for freight cars. They have increased their plant and ordered an additional number of tools from the Lodge & Davis Machine Tool Co , of Cincinnati, O.

The Brooks Arms and Tool Company, of Portland, Me., have decided to locate their plant at Woodfords, on land near the railroad crossing, and they will soon erect a suitable plant for the manufacture of the various styles of arms manufactured by them.

The Jones & Lamson Company, of Springfield, Vt., have issued a new edition of their catalogue, "Rapid Lathe Work, New Method." It is one of the finest publications of the kind ever issued, and should be in the hands of every one interested in manufacturing processes.

Dingley, Foss & Co., Auburn, Me., shoe manufacturers, are adding to their plant a 60 H. P. engine built by J. W. Penney, of Mechanic Falls. This will give them 100 horse-power. This factory is receiving large orders and has known no let-up in activity for many months.

A new catalogue has just been issued by James Beggs & Co., 9 Dey street, New York, giving the principal dimensions of their line of engines, boilers, heaters, etc., and containing useful tables for boiler settings. The illustrations and typographical work are very clear, and the general make-up is good.

The Portland (Me.) Packing Company are to erect a corn factory in Newport, Me., 355½ acres having been pledged. Only 300 acres were required to secure the factory. The site has been purchased, and the plan of the factory has been drawn. A three-inch pipe from the condensed milk factory will furnish water.

The removal of a rolling-mill plant from Burlington, Iowa, to Decatur, Ill., is under consideration. John W. Holiday is the Burlington promoter. The proposed Decatur plant, to cost $150,000, will give employment to 400 men, with a $20,000 monthly payroll. Decatur is expected to take $65,000 stock with a guarantee of dividends.

The Bangor (Me.) Edge Tool Co. is making extensive improvements upon the mill in Westfield, Me , where the wooden portion of its widely used tools is manufactured. The old boiler and engine have been removed, and a new boiler and engine of 50 horse-power will be put in for the more rapid manufacture of handles for cant dogs.

A company is forming under the old charter of the Yarmouth Manufacturing Company for the purpose of furnishing power for lighting Yarmouth, Me., and Freeport, Me., by electricity by night and running manufactures by day. A part of the stock is already subscribed, and work will be begun as soon as the balance is taken.

The Scranton Traction Co., of Scranton, Pa., have placed the contract for the buildings of their new plant with the Berlin Iron Bridge Co., of East Berlin, Conn. The boiler and engine room will be 65 feet wide by 200 feet long, with a machine shop and car shed 93 feet wide by 225 feet long. The entire plant will be fire-proof, of the well-known Berlin construction.

There is water-works agitation at Darien, Conn.; Lowell, Mass.; Goshen, Ind.; Quincy, Ill.; Huntington, Ind.; Terre Haute, Ind.; Coxsackie, N. Y.; Spring City, Pa.; New Albany, Ind.; Hammond, Ind.; Seymour, Ind.; Peoria, Ill.; Valparaiso, Ind.; Elgin, Ill.; Fort Smith, Ark.; Indianapolis, Ind.; Connersville, Ind.; Syracuse, N. Y.; Attleboro, N. Y.; Springfield, Mass.

The Johnston Harvester Co., of Batavia, N. Y., are sending to their friends the compliments of the season accompanied by some very charmingly printed illustrated books containing such literary gems as "Gray's Elegy," Longfellow's "The Village Blacksmith," and "The Old Oaken Bucket." The advertising feature in these is not obtrusive, and the books will undoubtedly be appreciated by those who receive them.

Newport, Me., expects to have a new industry. The Cooper Bros., of Searsmont, have decided to buy a lot of about one hundred acres of land and erect a large steam mill to saw bass lumber, if the town will exempt them from taxation for 10 years. About fifty of the citizens have taken hold of the project, and think that without doubt they have secured this promising industry for the town.

A new company is being organized at Elmira, N. Y., for the manufacture of patented specialties and novelties. The concern will be an incorporated one, and work on the buildings will be begun at once. Considerable machinery will be required, both wood and iron-working, as well as boiler, engine, shafting and small tools. Manufacturers are requested to send circulars and catalogues, addressed for the present to D. C. Giles, as above, Elmira, N. Y.

The Whitman Agricultural Works, Auburn, Me., made and sold 730 of their King of the Cornfield seed planters and fertilizer distributers the past year. A thousand for next season are already ordered and two thousand of the machines will be built between now and spring. The concern has voted to increase its capital stock $24,000 in order to meet the expenses of enlarging its already extensive plant, which is made necessary from the rapidly increasing business in the several departments.

Subscriptions are being solicited in Presque Isle, Me., to stock at $100 shares, in a new corporation to be known as the Presque Isle Manufacturing Company. This is a company to be organized to manufacture heavy farm wagons of the style known as the Holly patent jigger wagon, invented and patented by a Presque Isle man, Eugene Holly, who, with E. E. Parkhurst, is one of the chief promoters of the enterprise. The capital stock is placed at $10,000, and a meeting to perfect the organization has been called for December 19th at Col. C. P. Allen's office.

The Calumet Works of the Calumet Iron and Steel Company, Chicago, Ill., has been sold to a Cleveland (O.) syndicate, headed by A. M. Wilcox, for $500,000. The plant is said to have originally cost $2,000,000, and has a capacity of 50,000 net tons of bar-iron and 20,000 net tons of steel. The mill will be repaired and started on merchant iron January 1. This mill was first operated in August, 1876; has 38 single puddling furnaces, 6 scrap and 6 heating furnaces; 9-inch, 14-inch and 22-inch trains, and 132 nail machines. The steel department has four 4-gross tons open hearth furnaces, added in 1882.

Machinists' Supplies and Iron.

NEW YORK, January 7, 1893.

Iron—American Pig—We quote standard Northern brands, No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.25 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20 for Eglington.

Antimony—The market is barely steady, and dull. We quote L. X., 10¼c. to 11¾c.; Cookson's, 10¾c to 11c.; Hallett's, 10¼c. to 10½c., and U. S. French Star, 11c.

Copper—Holders of Lake Copper are asking 12.30c.; companies continue to quote 12¼c. without business; buyers are bidding 12.10c. Casting Copper is held at 11¼c. to 11½c.

Lead—Spot supplies are wanted at 3.75c., but there is no business. January delivery is held at 3.95c.

Lard Oil—Prime City is quoted at 90c. to 91c.; Western on spot at 87c. to 88c.

Spelter—The market is weak; 4.40c. is asked, and 4.35c. bid for good brands.

Tin—The market is more active. Sales have been made at 19.70c. to 19.85c. for January, and 19.85c. to 19.90c. for February.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded

Mechanical draftsman good designer, wants, situation. Address Box 77, AMERICAN MACHINIST.

Wanted—A man thor'ly familiar with the construct'n & manuf'e of injectors. B. B., AM. MACH.

Draftsman familiar with machine tools, jigs, fixtures, etc., desires position. H. M., AM. MACHINIST.

Wanted—A first-class tool and die maker. The Hornell Iron Works, Hornellsville, N. Y.

Young mechanical draftsman, exp'd in steam engine work, desires situation. Box 80, AM. MACH.

Position wanted by exp'd designer & draftsman; technical educat'n & shop exp. Box 81, AM. MACH.

Wanted—Skillful machinists; two vise or floor and two lathe hands. Apply 115 Plymouth St., Jersey City.

A mach. of fair tech'l educa'n, fam'r with English, French and German, would take reliable engagement in the World's Fair. Box 82, AM. MACH.

Wanted—Situation in the South or Southwest as tool maker; 10 years' experience. Address Tool Maker, Box 468, Waterbury, Conn.

First-class draftsman, with experience on large machines, and best references, is open to fair offer. Address Immediate, AM. MACHINIST.

Wanted—Foreman pattern maker, familiar with pump work. Address, giving age, experience, and wages expected. Box 71, AMERICAN MACHINIST.

Mechanical draftsman, age 29, technical graduate, experienced in designing and erecting of machinery, wants position. Refs. Box 76, AM. MACH.

Wanted—Blacksmith—one good gen. blacksmith in machine and car shop located in western Pennsylvania. Address "Smith," AM. MACHINIST.

Position as foreman in South or West, by energetic, first class modern machinist; 15 years' exp.; sober, steady; Dane; best refs. Ioof, AM. MACH.

Wanted, immediately—30 A1 tool makers; good wages. Address, stating age and experience, American Engine Co., Bound Brook, N. J.

Wanted—Position by mechanical draftsman, with shop and 6 years' drawing room experience. Address G., AMERICAN MACHINIST.

Position Wanted—Technical training, 12 years' exp. as draftsman, pattern maker, machinist; good designer & can make estimates. A. L. Bowen, 207 McIndoe St., Wausau, Wis.

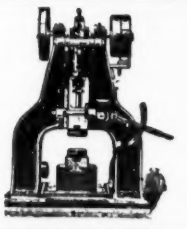
Wanted—A mechanical draftsman graduated from the Royal Technical High College, Stockholm, Sweden, with 12 years' practical experience, 2 years in this country, desires position. Box 79, AM. MACH.

HACKNEY HAMMERS

Meet all requirements more fully and satisfactorily than any other of its competitors.

INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.

WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
20 Johnson St., CLEVELAND, O.



List iron cut gears.
List iron cast gears.
List brass gears.
Gears made or cut to order.
Treatise on gears, $1.00.
Gear Book, fifteen cents.
Gear cutting machinery.
Planed bevel gears.
George B. Grant,
Lexington, Mass.
Philadelphia, Pa.

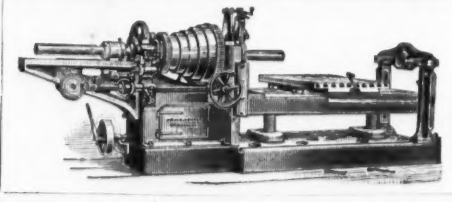
CAR LUBRICATION,
BY
W. E. HALL,
12mo. Cloth, $1.00.
JNO. WILEY & SONS, - NEW YORK.

VANDERBEEK'S
TRADE MARK.
MILLING MACHINE.
FIVE STYLES
THE STATES MACHINE CO.,
HARTFORD, CONN.

Bradley Hammers.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a BRADLEY HAMMER will soon pay for itself, by what it will save over any other similar tool. Send for circulars.

BRADLEY & COMPANY, SYRACUSE, N. Y.



BETTS MACHINE CO.,
WILMINGTON, DEL.
MACHINE TOOL BUILDERS.
IMPROVED PATTERNS! LATE DESIGNS!

A NEW PRESSURE REGULATOR.

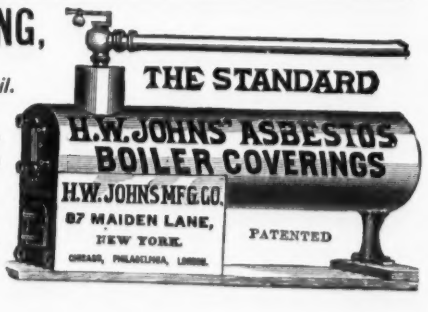
To meet the special requirements of elevator work, we have designed a new Pump Pressure Regulator which is positive and sensitive in its action. It is only for elevator work. As to the workmanship, we need say nothing, as all of our customers know that nothing inferior is sent out from our factory.

MASON REGULATOR CO.,
BOSTON, MASS.

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.



✲WANTED✲

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Wanted—Foreman for mach. shop manufacturing cast-iron sectional boilers. One with knowledge of foundry work, particularly radiator work, preferred. H. C., AMERICAN MACHINIST.

Young mechanical engineer, with varied experience as designer, desires to travel for large manufacturer of power machinery. First-class references. Moderate salary until fully identified with ability. Address Travel, AMERICAN MACHINIST.

Wanted, immediately—10 lathe hands, 10 vise hands, 6 braziers; wages, $2.25 to $2.50; steady work all winter; board in Beaver Falls costs $3.50 to $4.00 per week. Eclipse Bicycle Co., Beaver Falls, Pa.

Wanted—At once, by the Webster Mfg.Co., a number of first-class tool makers on fine work. Apply at once, stating experience in full, wages expected, and earliest date of commencement, Chas. E. Davis, Chief Eng'r Webster Mfg. Co., Chicago, Ill.

Wanted—3 competent machinists and 2 good molders for dry and green sand molding in shop in western Pennsylvania: must be of good habits and reliable; to suitable men good wages will be paid, and a steady position offered. Address Mechanic, care AMERICAN MACHINIST.

Wanted—Foreman for a foundry situated in Indiana. A comp't man having exp. in gen'l machine & architectural iron founding can obtain a pos'n with an old established concern employing from ten to twenty men in the foundry; must have executive ability and be temperate; a permanent position to a good man. Address, giving age, nationality and experience, The Lay Pail Co., Noblesville, Ind.

DESIRABLE SECOND-HAND MACHINERY.

LATHES.

1 25 in. x 25 ft. L. W. Pond, Compound Rest, Rod Feed. Good order
1 17 in. x 8 ft. Blaisdell, Rise and Fall Rest. Good as new
1 17 in. x 6 ft. Blaisdell, Rise and Fall Rest. Good as new
1 16 in. x 7 ft. Bement, Plain Rest, heavy fine Tool. A1 condition

PLANERS.

1 30 in. x 30 in. x 8 ft. Hewes & Phillips, Spiral Geared, one head on rail, very fine modern Tool. Good as new
1 15 in. x 15 in. x 3 ft. Wilkinson. A1 condition
1 22 in. x 18 in. Blaisdell Crank Planer. Good as new
1 24 in. x 24 in. x 5 ft. Whitcomb Planer. Good order

MISCELLANEOUS.

1 4 in. Hubbert & Rogers Cutting Off Machine. A1 condition
1 20 in. Prentice Bros. Drill, Wheel Feed, with Chuck. Good order
1 20 in. Reed Drill, Lever Feed, with Chuck. Good as new
1 3 Spindle Barnes Drill Press. Good as new
1 No 1 2-Spindle Garvin Drill. Good as new
1 No. 2 4-Spindle Garvin Drill. Good as new
1 No. 3 4-Spindle Garvin Drill. Good as new
1 No. 2 Brown & Sharpe Screw Machine, Automatic Chuck and Wire Feed. A1 condition
1 15 in. x 5 ft Hendey Turret Lathe. Good order
1 15 in x 5 ft. Jones & Lamson Turret Lathe, with 3 jaw Universal Chuck. Good as new
1 No. 2 Garvin Power Miller, Swivel Vise and Arbor Good as new
1 No. 4 Garvin Miller, Arm, Vise and Arbor. A1 condition

Nearly 500 other New and Second hand Tools in Stock. Write for list and prices.

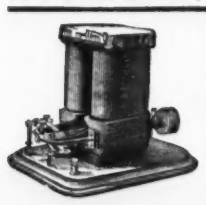
THE GARVIN MACHINE COMPANY,
CANAL AND LAIGHT STS. NEW YORK.

SECOND-HAND AND NEW MACHINERY.

ON HAND.

72 in. x 48 x 33 ft. Planer 3 Heads.
54 in. x 42 in x 24½ ft. do 2 do
42 in x 42 in. x 16 ft. do 1 do
39 in. x 36 in. x 14 ft. do 1 do
36 in. x 36 in. x 8 ft. do Powell A1.
30 in. x 30 in. x 8 ft. do 1 Head.
26 in. x 24 in. x 7 ft. do 1 do
25 in. x 24 in. x 5 ft. do 1 do
22 in. x 21 in. x 5 ft. do 1 do
90 in. x 30 ft. Triple Gear Engine Lathe, Ames A1
50 in. x 30 ft. Bed, Triple Geared. New Engine Lathe.
30 in. x 28 ft. D. W. Pond Shafting Lathe.
32 in. x 12, 14, 16, 18 ft. Bed. New Engine do
28 in. x 12, 14, 16, 18 ft. do do do do
21 in. x 10, 12 ft. do do do do
20 in. x 7½ & 8 ft. do 2d Hand do do
18 in. x 6, 7 & 8 ft. do New & do do do
17 in. x 8 ft. do do do do
16 in. x 6 & 8 ft. do do do do do
15 in. x 6 & 8 ft. do do do do do
14 in. x 6 ft. do do do do do
Car Axle Lathe, Bement.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in Drills.
Bolt Cutters.
Brown & Sharpe Universal Miller.
Lot of Lincoln Pattern Millers.
No. 2 Screw Machine. Garvin.
2, 3 and 4 Spindle Drills. Garvin
No. 75 Bliss Presses.
1 Bk. Geared Miller. U. V. Co. Good.
1100 and 3000 lb. Bement Steam Hammer.
100 and 150 lb. Steam Hammer.
40 H. P. Vert. Engine. N. Y. S. S. P. Co.
11 in. x 18 in. Hor. Engine. A1 Order.
12 in. x 24 in. Corliss do do

GEO. PLACE MACHINE CO.,
120 BROADWAY. NEW YORK.



ENGINE CASTINGS.

1-8 to 6 H. P. Horizontal and Marine 8, 16 and 60 Light DYNAMOS.

Fan, Sewing Machine and Boat Motors. Either parts with instructions or finished machines. Our $25.00 PLATING DYNAMO runs 30 gal. of solution. Send stamp for Catalogue.

PALMER BROS., Mianus, Conn.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d-hd lathes & planers. S.M.York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

"Pond" screw cutting lathe, 20"x10 feet; splendid order; complete, $165. 229, AM. MACHINIST.

Will sell cheap, few sets steel letters and figures. A. Cowan, 339 Chestnut St., Philadelphia, Pa.

To Rent—Foundry in New England town, well equipped, conveniently located; machine and pattern shop in operation adjoining. W., 2, AM. MACH.

Simple adjustable ball and roller journal bearings to fit all machinery; wanted party to assist in mfg. and introducing. Box 78, AM. MACHINIST.

For Sale—Iron Planer (new) planes 8'x24"x22". $375. Patterns for Iron Planer, Wood Planers, Parallel Vises, etc., cheap. S. E., AM. MACHINIST.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R.I.

Special, experimental or other light machinery manufactured. Best equipped shop in the West for fine work. Manufacture one of the best hollow spindle bench lathes for the tool room or for manufacturing. Write us. Moseley & Co., Elgin, Ill.

SECOND-HAND MACHINERY

Of Modern Style, in First-class Order.

ENGINE LATHES.

14 in. x 6 ft. Raise and Fall Rest, complete. Fitchburg
15 in. x 6 ft. do do do Lathe & Morse.
15 in. x 6 ft. Plain and R. and F. Rests complete. Fitchburg.
16 in. x 6 ft. with Taper Attachment, do do
16 in. x 8 ft. Compound Rest. do do
18 in. x 8 ft. Raise and Fall Rest, do New Haven.
20 in. x 10 ft. Cpd. Rest & Cross Fd., complete. Ames Mfg. Co.
20 in. x 10 ft. do do do Fitchburg
20 in. x 18 ft. do do and Chuck, do Lathe & Morse.
22 in. x 12 ft. do do Fitchburg.
24 in. x 13 ft. do do do
27 in. x 12 ft. do do do
35 in. x 14 ft. do do do
50 in. x 18 ft. do do Triple Geared. do

PLANERS.

21 in. x 5 ft. Old Style—Fair Order. Low Price.
25 in. x 8 ft. with all improvements, complete. Fitchburg.
27 in. x 6 ft. Full Auto. Feeds, etc. do Pond.
30 in. x 8 ft. Heavy Pattern. do Gleason.
42 in. x 9 ft. do do do Hewes & Phillips.
48 in. x 12 ft. with all improvements. do Fitchburg.

SHAPERS.

8 in. Stroke, Crank Motion. Gould.
9 in. do do do Extra Power. Hewes & Phillips.
14 in. do Trav. Head. Good as new. Fitchburg.
15 in. do Friction Style. Imp. Tilting Table. Hendey.
15 in do Crank Motion, with all improvements
24 in. do Triple Geared, do do

DRILLS.

20 in. Swing with Wheel Feed. Prentice.
24 in. do Back Geared and Auto. Feed. Ames
30 in do do do do Fitchburg.
Radial Drill, 6 ft. Arm, complete. do

MISCELLANEOUS.

Upright Boring and Turning Mill, 38 in. complete.
Hor. Boring and Drilling Machine. Fitchburg.
Slotting Machine. 8 in. Stroke, Auto. Feeds, etc., complete.
Gould & Eberhardt 36 in. Auto. Gear Cutter.
Brown & Sharpe Vertical Turret Chucking Machine.
Brown & Sharpe No. 5 Screw Machines, complete.
Jones & Lamson No. 3 do do do
Pratt & Whitney Profiling Machine, 2 Spindles.
Boiler Bending Rolls, 8 and 10 ft., improved.

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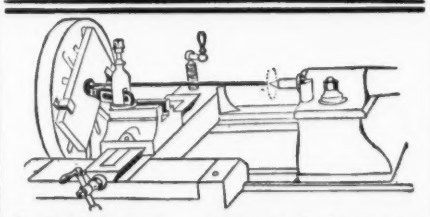

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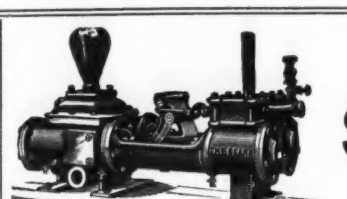

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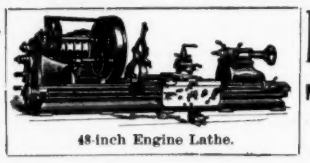
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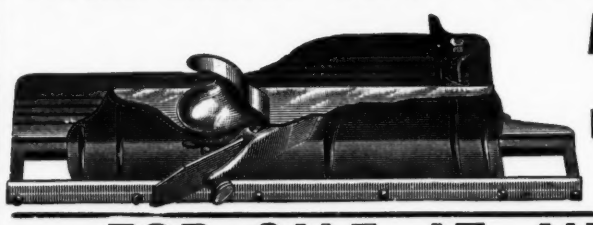

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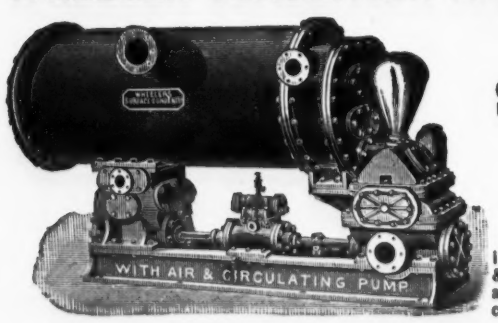

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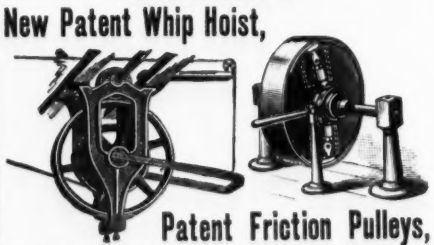

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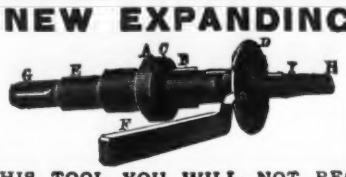

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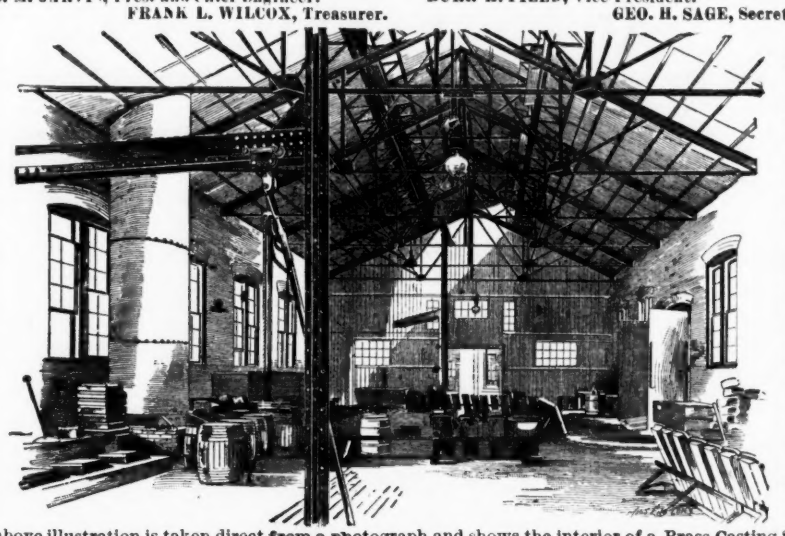

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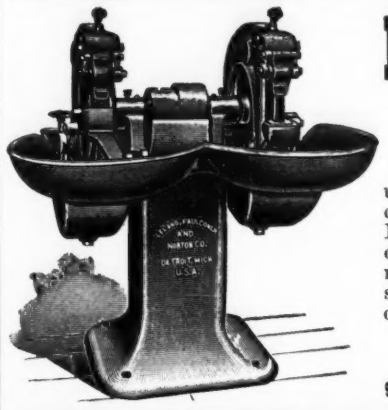

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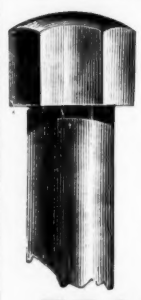

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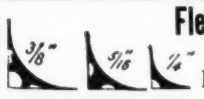

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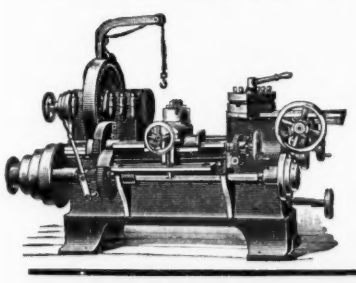

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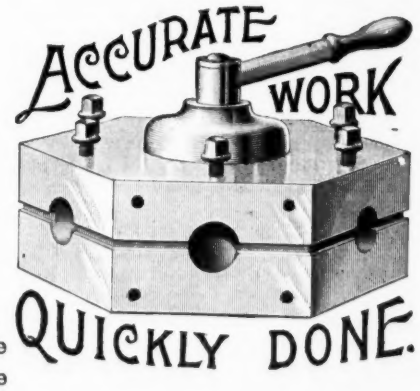

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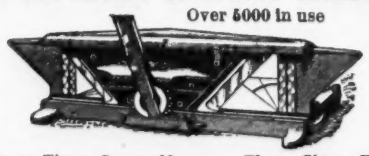

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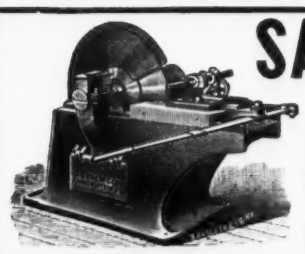

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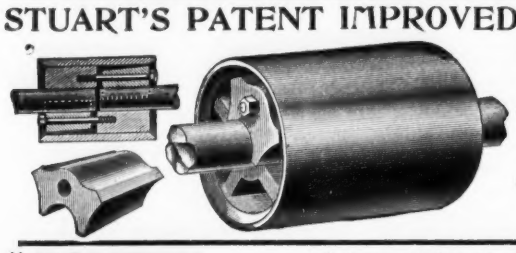

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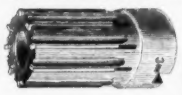
Adjustable  **SHELL REAMERS**

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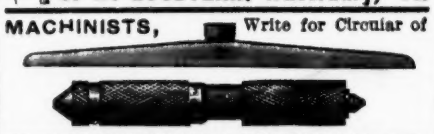

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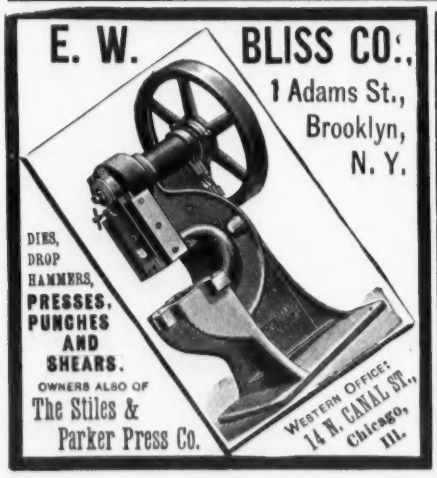

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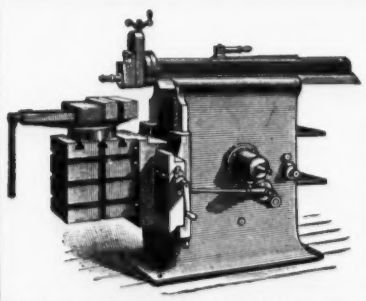

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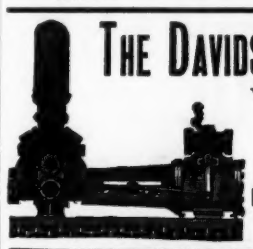

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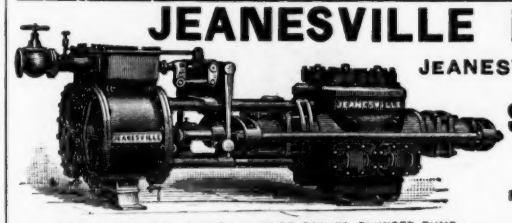

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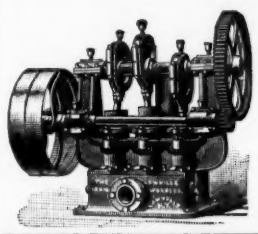

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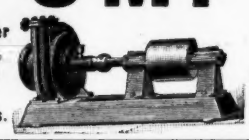

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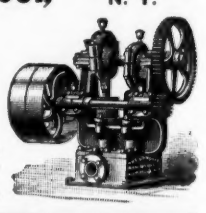

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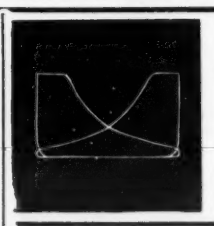

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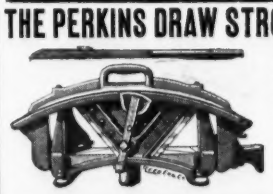

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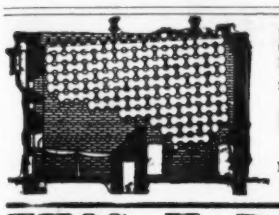

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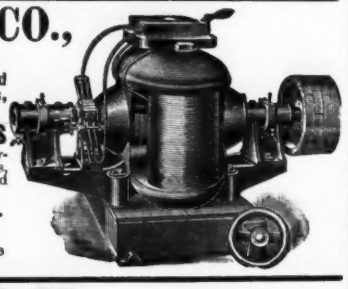

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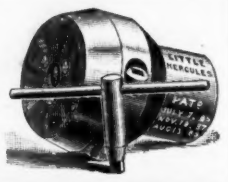

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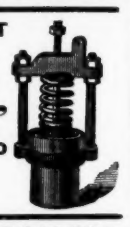

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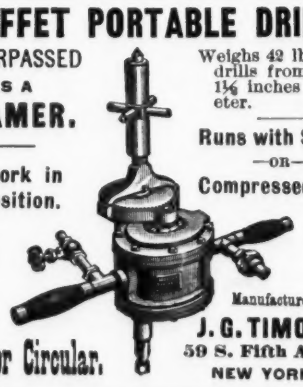

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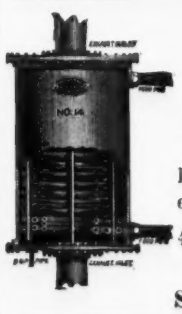

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16 in.	18 in.
18 1-2 in.	21 1-2 in.
21 1-4 in.	26 in.
24 in.	30 in.
30 in.	36 in.
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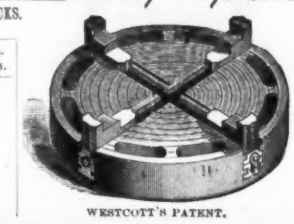

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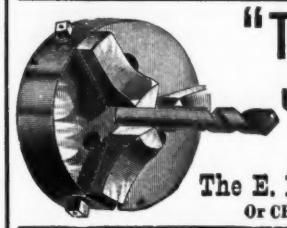

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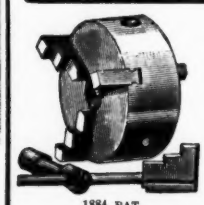

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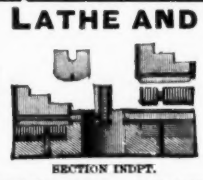

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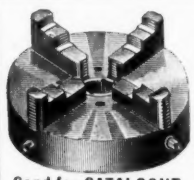

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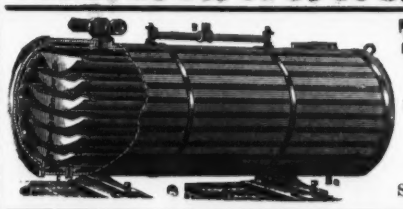

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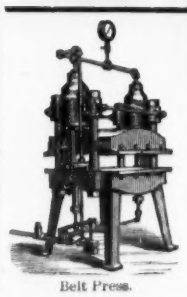

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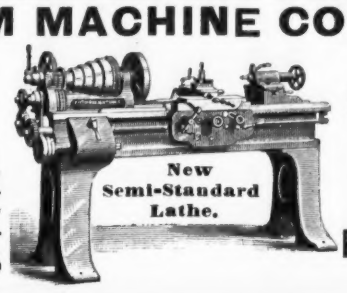

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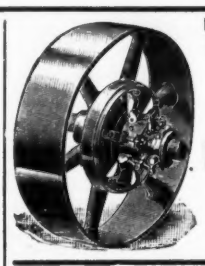

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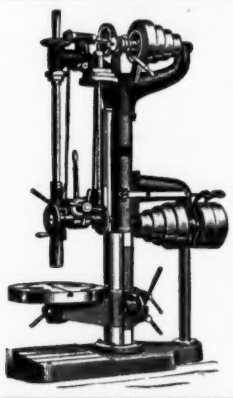

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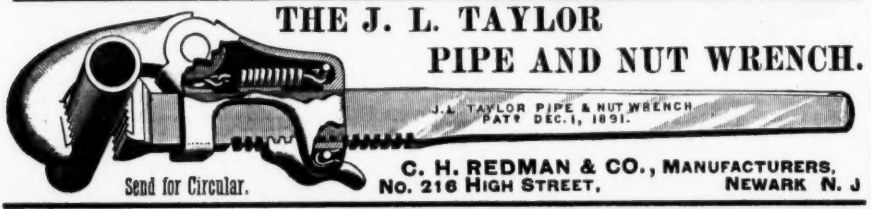

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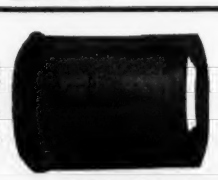

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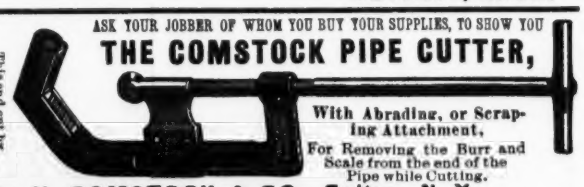

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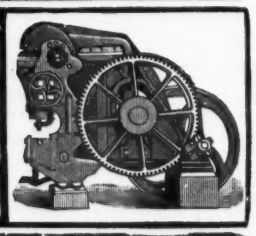

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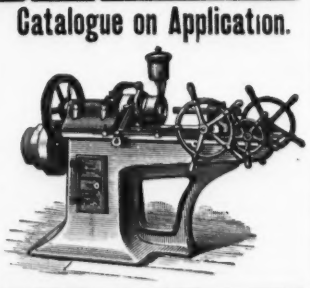

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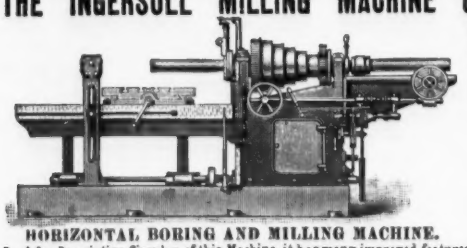

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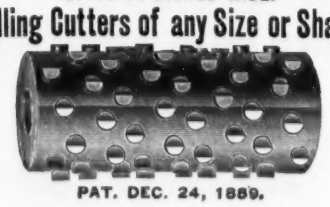
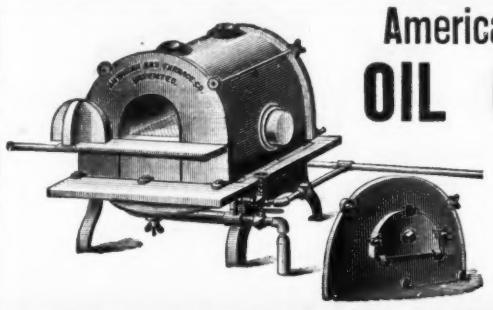


PAT. DEC. 24, 1889.



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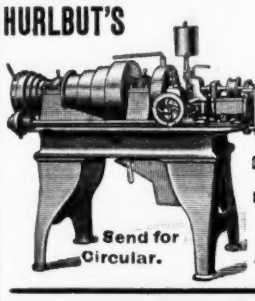

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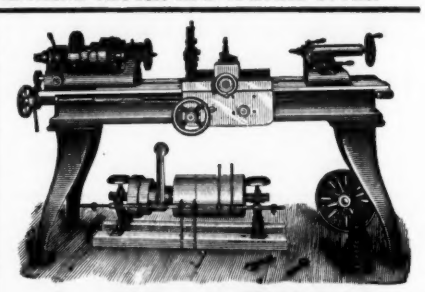

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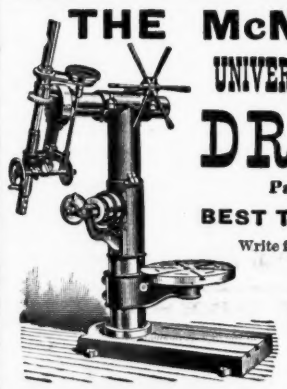

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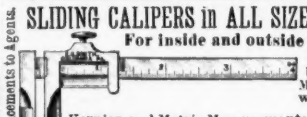

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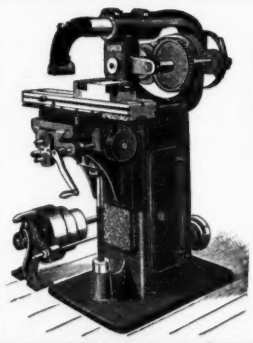

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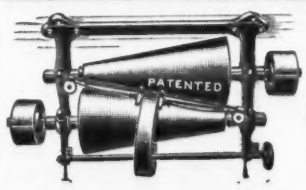

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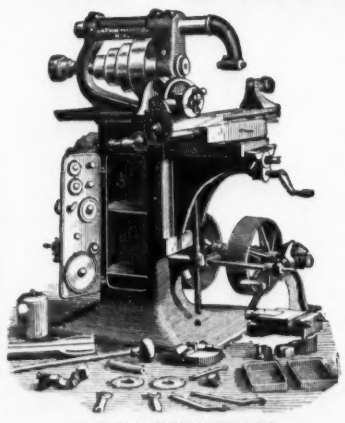

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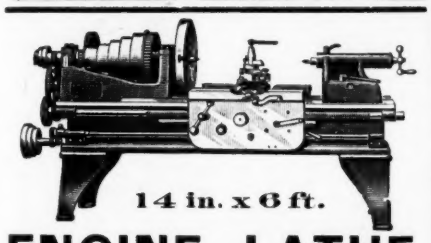

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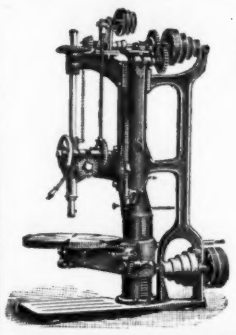

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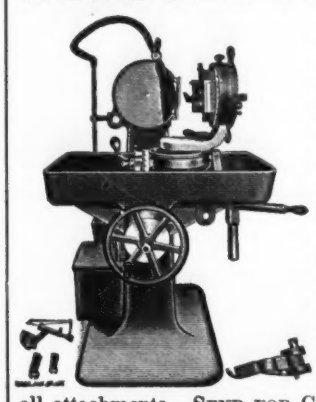

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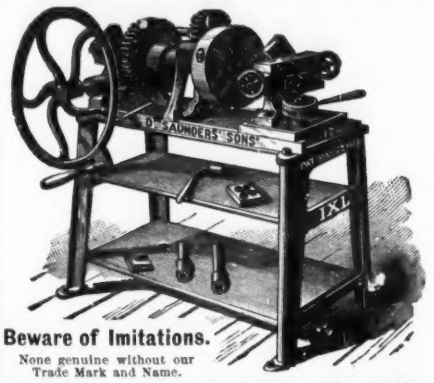

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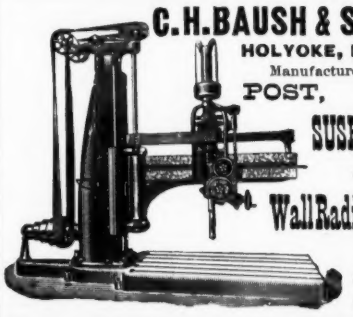

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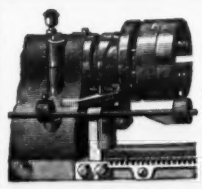

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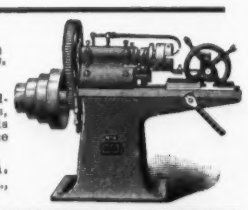

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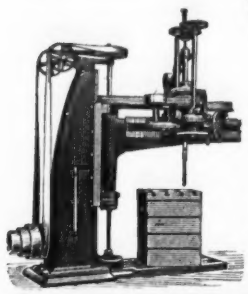

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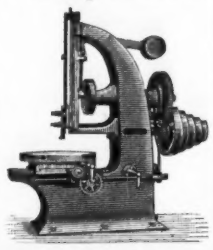

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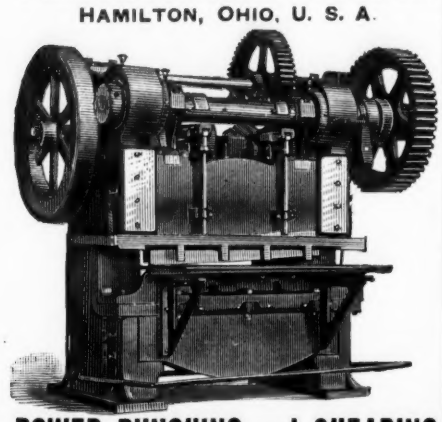

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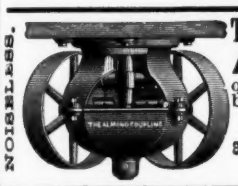

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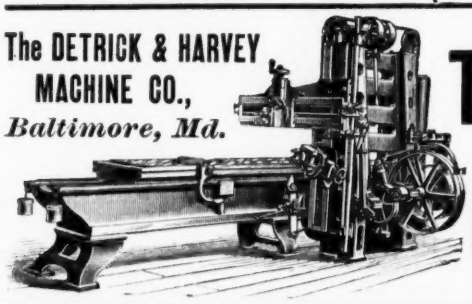

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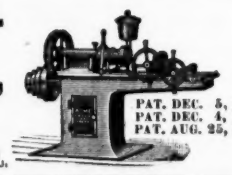

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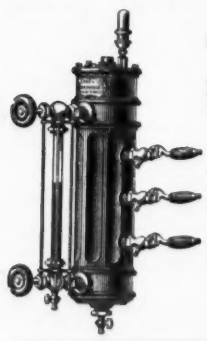

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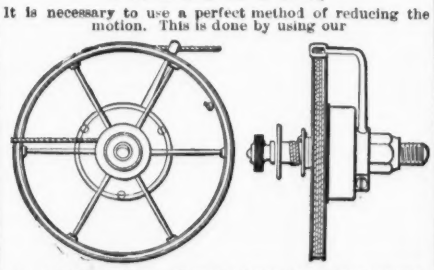

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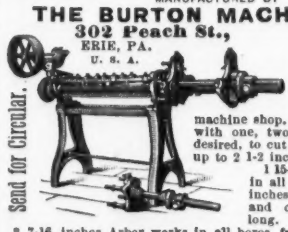

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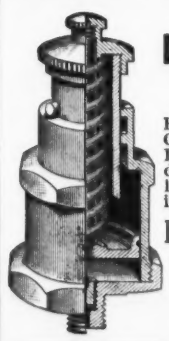

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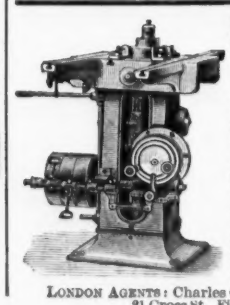

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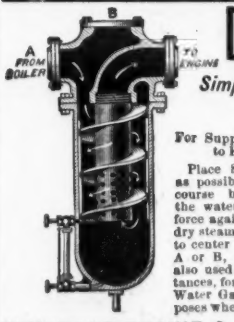

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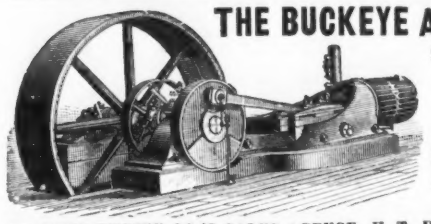

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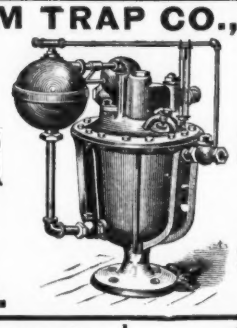

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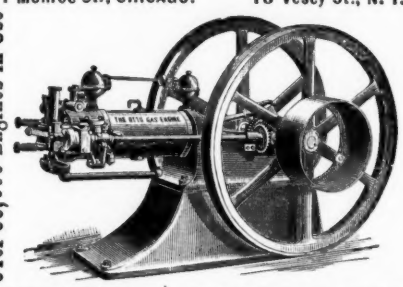

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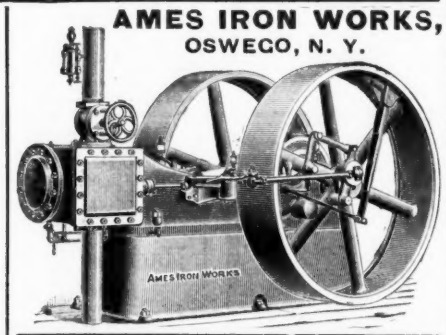

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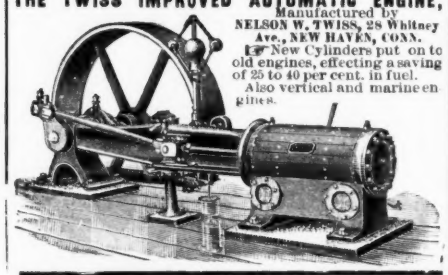

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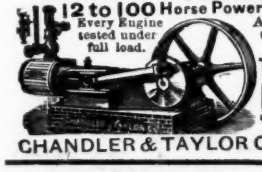

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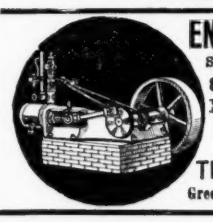

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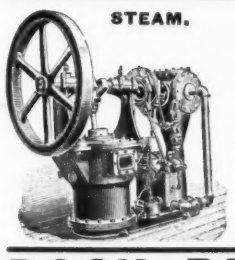

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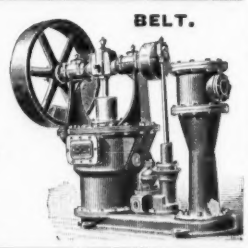

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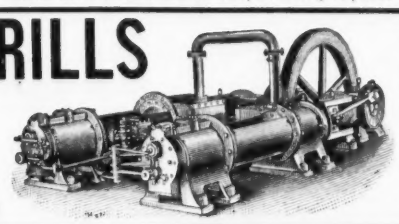

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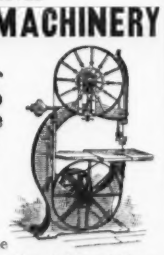

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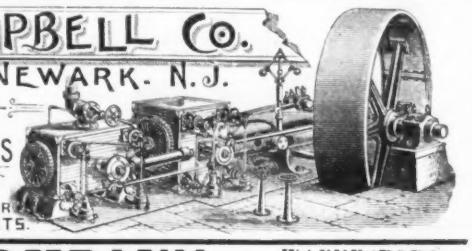

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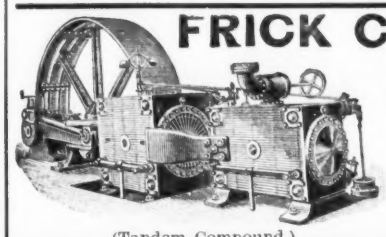

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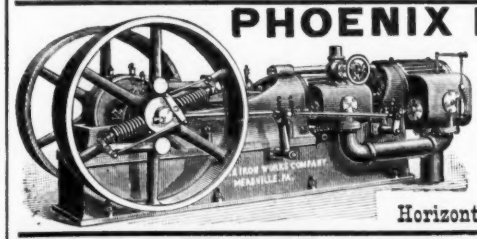

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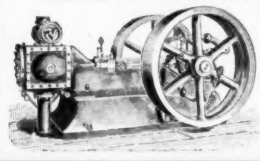

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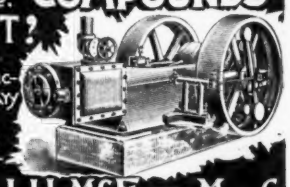

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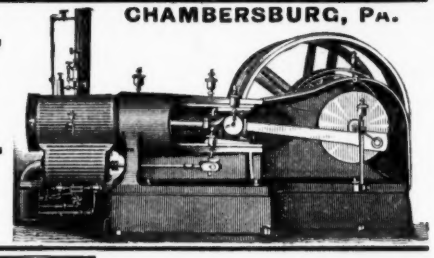

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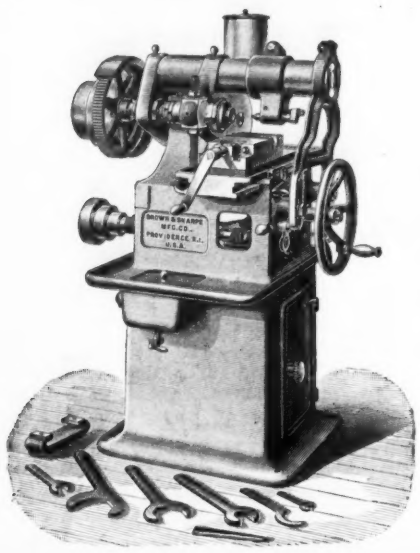

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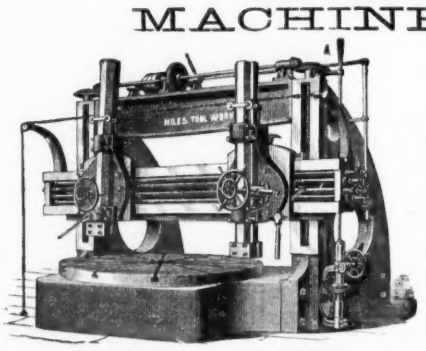

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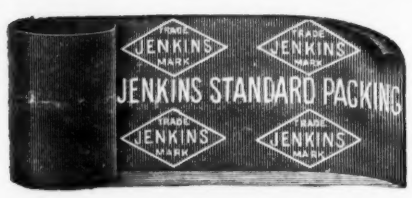

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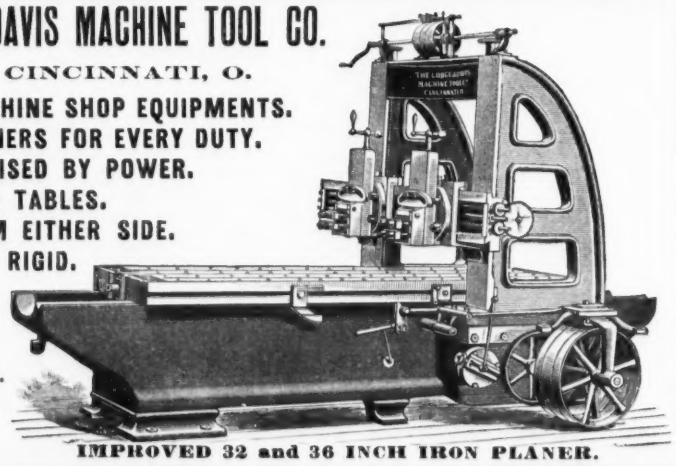

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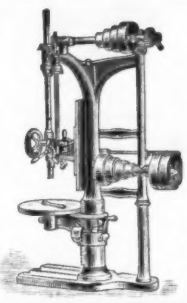

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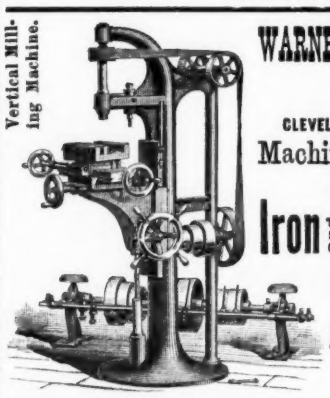

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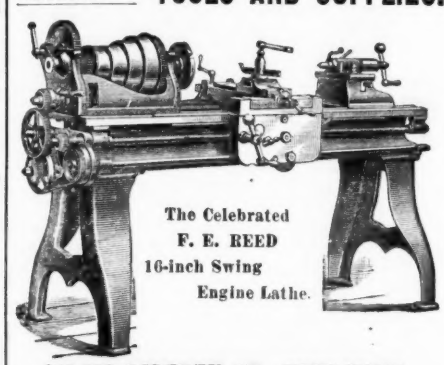

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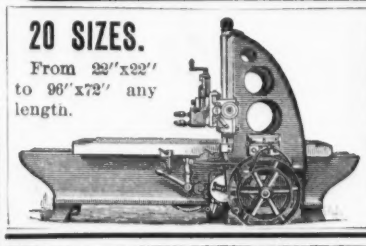

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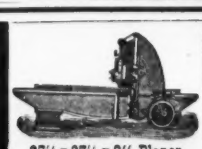

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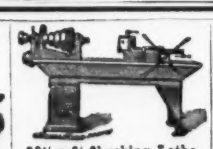
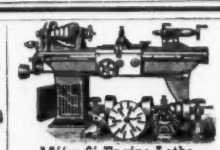
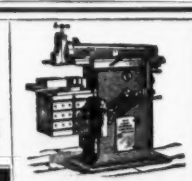


20" x 6' Chucking Lathe.



16" x 6' Engine Lathe.



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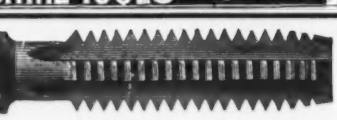

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